Executive Summary

This report has been produced to consider crowd safety issues, and the feasibility and implications of retaining the following three locally listed buildings on High Road:

- No. 746 High Road (known as the Edmonton Dispensary)
- No. 748 High Road (known as the Redhouse Coffee Palace)
- No. 750 High Road (formerly Valentino's Nightclub)

All three of these buildings were retained in the previously approved scheme (HGY/2010/1000) ("the Consented Scheme"). However, as detailed in the Planning Statement prepared by DP9, circumstances have changed since the previous proposals were approved in 2011.

Movement Strategies (MS) on behalf of THFC has undertaken a detailed assessment of current conditions at the existing stadium. This assessment has identified large numbers of spectators walking in the High Road before a match as a consequence of the 'pinch point' created by the narrow footpath in front of nos. 746/748 and 750 High Road.

The Consented Scheme provides a "canyon" behind the three buildings, which was designed to divert spectators away from this recognised pinch point. MS has concluded that the canyon would not be effective in diverting spectators from the natural route along the High Road.

As such, the retention of the four buildings in the Consented Scheme will deliver a clear risk to pedestrian safety.

Having identified this risk, THFC and its design team are committed to securing a design to reduce the degree of risk to spectators and the general public to as low as reasonably practicable ("ALARP"), which presumes that change is made in favour of safety unless the cost is grossly disproportionate to the benefit.

MS has undertaken a detailed assessment to determine acceptable levels of service in this situation, as a basis for evaluating a series of alternative options to seek to reduce the risk to ALARP.

The proposed new scheme designed by Populous, which involves the removal of the three locally listed building, has been tested using the same methodology.

This option has been found to be acceptable in crowd safety and highways and transport terms. This option reduces the risk to spectators and the public to ALARP.

A number of options have been considered, ranging from the introduction of intensive stewarding and barriers, to the temporary and permanent closure of the bus lane and both south bound lanes, to more radical options including moving the High Road, providing a flyover or tunnel, or constructing an elevated walkway in front of the NDHA. MS conclude that the retention of the three buildings, delivery of the 'canyon' and the provision of intensive stewarding and barriers on the Eastern and Western sides of the High Road would not provide a satisfactory solution to the identified safety concerns.

The MS analysis excludes the additional impacts arising from reoccupation of the buildings by food and beverage ("F&B") operators, which are the only viable source of commercial occupier demand for the three buildings. However this demand is conditional on the provision of external space for smoking/drinking on match days. This external space would need to be limited and contained spatially, and access and queuing managed to minimise congestion in the canyon.

Based on the views of Davis Coffer Lyons, it is uncertain whether the imposition of such management restrictions would be compatible with operators' requirements for these units. In these circumstances the viability of these units for F&B uses is uncertain given the constraints imposed by safety considerations.

The series of options involving the temporary/permanent closure of the southbound bus lane, or the closure of both southbound lanes all cause significant highways and transport issues, including congestion, unacceptable route diversions, and loss of public transport accessibility, which are inconsistent with the transport strategy and wider accessibility objectives. In any event, none provides a satisfactory, permanent solution to the identified safety concerns.

The more radical options have been discounted on the basis that they are not deliverable, (without fundamentally undermining the viability of the project and/imposing unacceptable delays to delivery), and that any possible benefits in terms of the retention of the three buildings would be outweighed by very significant highways, traffic and heritage impacts elsewhere. These options would be likely to lead to significantly more harm to heritage assets than the proposed scheme.

In these circumstances, the revised proposals, involving the removal of the three buildings (but the retention of the statutorily listed Warmington House), provide the only deliverable solution which is acceptable in highways and transport terms and reduces the identified risk to spectators and the public ALARP. This is a very important material consideration, which must be weighed in the overall planning and heritage balance, which is set out in the Planning Statement.

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1.0 Introduction

1.1 This report has been produced to consider crowd safety issues, and the feasibility and implications of retaining the following three locally listed buildings on High Road:

- No. 746 High Road (known as the Edmonton Dispensary)
- No. 748 High Road (known as the Redhouse Coffee Palace)
- No. 750 High Road (formerly Valentino's Nightclub)

1.2 All three of these buildings were retained in the previously approved scheme (HGY/2010/1000) ("the Consented Scheme"). However, as detailed in the Planning Statement prepared by DP9, circumstances have changed since the previous proposals were approved in 2011.

1.3 As part of a detailed review of the Consented Scheme THFC commissioned Movement Strategies ("MS") to undertake a review of the crowd safety matters.

1.4 Although Nos. 744 - 750 High Road have traditionally been treated as group for the purposes of preparing and evaluating previous planning applications for the replacement stadium scheme, there are important distinguishing characteristics that separate No. 744 High Road from Nos. 746 - 750 High Road.

1.5 No. 744 High Road is set back from the back of pavement by 14.5m, providing an effective footpath width of 10.2m[1] for crowd flow.

1.6 In contrast No. 746 is set back by 4.2m; No. 748 by 2.2m; and No. 750 High Road by 2.6m.

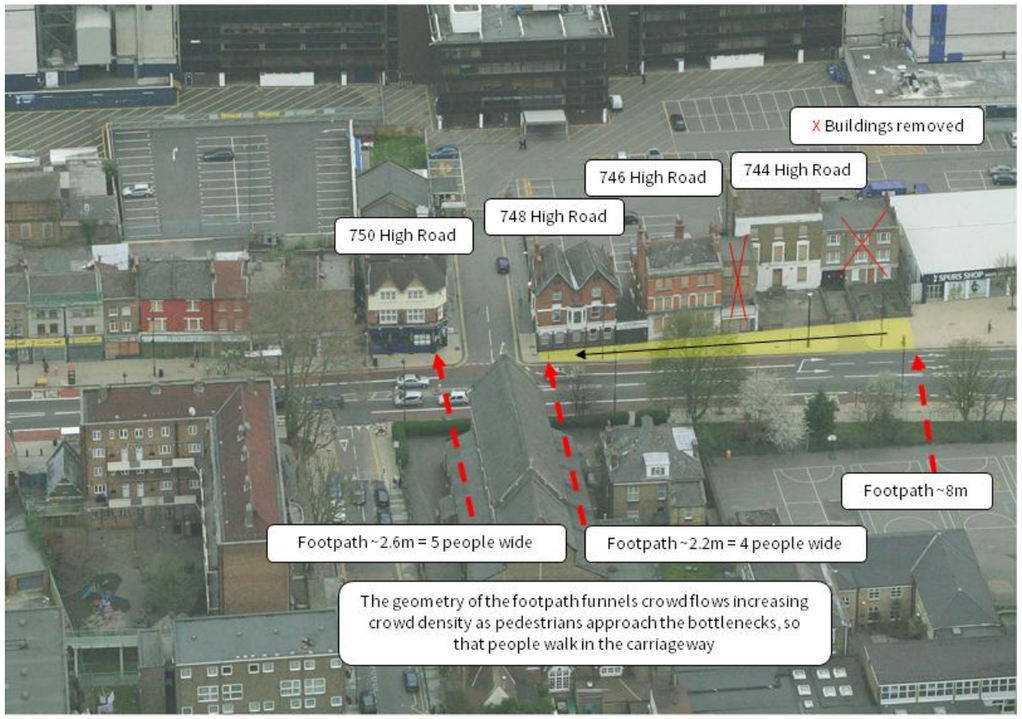

X Buildings removed
746 High Road
744 High Road
748 High Road
750 High Road
Footpath ~8m
Footpath ~2.6m = 5 people wide
Footpath ~2.2m = 4 people wide
The geometry of the footpath funnels crowd flows increasing crowd density as pedestrians approach the bottlenecks, so that people walk in the carriageway

Figure 1 Aerial view of 744 – 750 High Road

1.7 Whereas the footpath width formed by No. 744 High Road is sufficient to allow safe crowd movement, the narrow and narrowing pavement width caused (Fig. 1) by the much smaller set-backs in front of Nos. 746 - 750 High Road causes significant numbers of pedestrians to walk in the road before a match. Evidence for this is shown from the numerous crowd flow surveys undertaken during the 2014/15 season.

1.8 The significant numbers of pedestrians in the road presents risks to pedestrian and driver safety.

1.9 The A1010 High Road is a Strategic Road within the TfL road hierarchy – only one level below the Priority (Red) Routes such as the A10 south of Bruce Grove. The Northumberland Development Project is unusual in that it proposes a large stadium immediately adjacent to such a major road.

1.10 LB Haringey is the highway authority but TfL have an effective control over any works and traffic management within the public highway. Both authorities have a responsibility to safely manage the adopted highways. There are significant additional safety considerations associated with the operation of a stadium, and the licensing regime, which also have to be taken into consideration. Crowd safety is a key issue.

1.11 The relationship between the stadium and the use of the High Road gives rise to a number of important crowd safety and transport issues. Figure 2 shows stills from video surveys during the 2014/5 season, which illustrate the typical pre match situation at the pinch point. The pedestrian and vehicular conflicts, and resultant safety issues are self evident.

[1] Width reductions applied for the proposed new bus stop (2m) accepting that the bus stop furniture could be less obtrusive with appropriate design but would still attract waiting passengers, the stairs for Warmington House (1.9m), and a 0.2m edge effect on the bus stop and building edge in line with TfL Pedestrian Comfort Guidance.

Figure 2 Stills from video surveys during the 2014/15 season

1.12 This report:

- Explains why crowd safety issues arise;
- Sets out an analysis of current crowd flows;
- Explains the approach taken to minimise crowd safety risks;
- Identifies suggested targets to minimise risks to acceptable levels;
- Sets out predicted crowd flows for the new stadium;
- Analyses the relationship between crowd flow issues and the future use of the three locally listed buildings; and
- Explains the relationship between crowd flow issues and the wider transport strategy for the new stadium.

1.13 Against the background of this information the report analyses a number of design and management options retaining the three buildings and evaluates those options in terms of:

- Whether they will adequately resolve the crowd safety issues;
- Their implications for the local and strategic transport network;
- Their impact on the viability of the ongoing use of the three buildings; and
- Their deliverability.

1.14 This report has been jointly produced by Movement Strategies (crowd movement consultants); Populous (joint architects for the proposed stadium and Tottenham Experience); and Tim Spencer & Co. (transport consultants). The report should be read in conjunction with the Heritage Impact Assessment chapter of the Environmental Statement (and the separate Heritage Statement), which have been prepared by Donald Insall Associates, and the report by Davis Coffer Lyons which considers occupier demand for these units and potential occupiers operational requirements.

1.15 The Planning Statement (prepared by DP9) draws together all the relevant considerations, including safety, deliverability, transport and highway issues, heritage, and the wider heritage, regeneration and other substantial public benefits which the scheme delivers, to assess the justification for the removal of the three buildings in the context of the relevant legal and planning tests.

2.0 Analysis of Crowd flow survey data

2.1 Count locations and time

2.1.1 Counts of people walking on the road and walkway were undertaken from video footage of ingress to a number of matches in the 2014/15 season. The results from the match vs. Hull City on 16th May 2015, 15:00 are described below. This match represents a typical Saturday afternoon fixture.

2.1.2 Each minute from 13:35 to 15:05 was counted separately. Three locations were counted on the eastern footpath of the High Road:

- Outside 748 High Road where the total width is 2.2m, and effective width 1.8m
- Outside 750 High Road where the total width is 2.6m, and effective width 2.2m
- Just north of Paxton Rd where the total width is 4.5m and effective width 4.1m

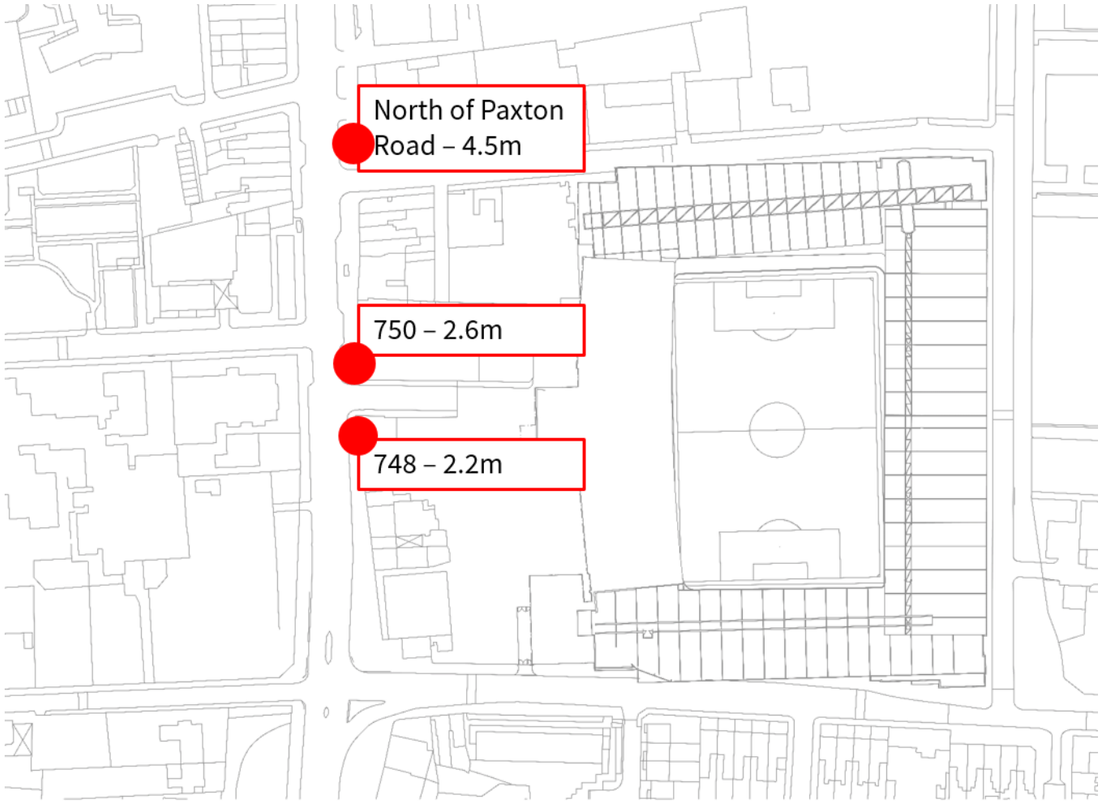


Figure 3 Locations where video surveys have been analysed and widths of walkways at these locations

2.2 Results

2.2.1 The number of people in the road is significant throughout the assessment period.

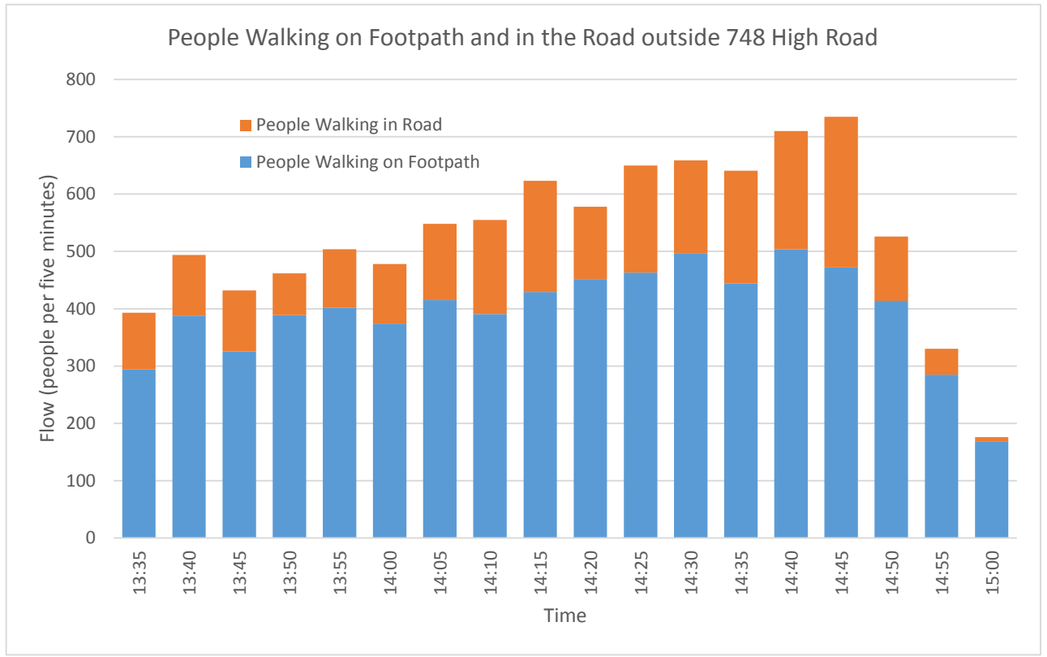


Figure 4 Flows each 5 minutes past 748 High Road during the match vs. Hull City 16th May 2015 15:00 kick-off

2.2.2 Throughout the assessment period, 2,388 (25% of) people walked in the road outside 748 High Road.

2.2.3 During the hour before the match this percentage was higher (27%), and higher again in the peak fifteen minute period (30 minutes to 15 minutes before kick-off) (32%) and peak five minutes (15 minutes before kick-off) (36%).

2.2.4 Survey data from other matches produced similar results. For example, in the hour before the West Ham match on 22 February 2015, 12:00pm kick off, 2,436 people walked in the road. That was 33% over the hour, and up to 40% during the peak periods.

2.3 Contraflow

2.3.1 Outside 748 and 750 High Road the flow was two-directional, with at most 61% observed in one direction during any five minute period. The direction which had the majority of flow was sometimes northbound and sometimes southbound. On average the flow in each direction was almost equal with 53% at 748 High Road and 56% at 750 High Road going northbound.

2.3.2 In contrast, north of Paxton Rd and thus north of the whole stadium, during the hour before kick-off, the flow was predominantly one directional southbound towards the stadium. There was only 3.5% contraflow over the hour and 1.5% during the peak fifteen minutes. Prior to that hour there was an average of 19% contraflow.

2.4 Analysis of Proportion in the road vs. flow rate

2.4.1 The total number of people in both on the walkway and on the road (people per minute) has been divided by the walkway width (metres) to produce a flow rate (people per metre per minute) for the three locations.

2.4.2 Outside 748 High Road

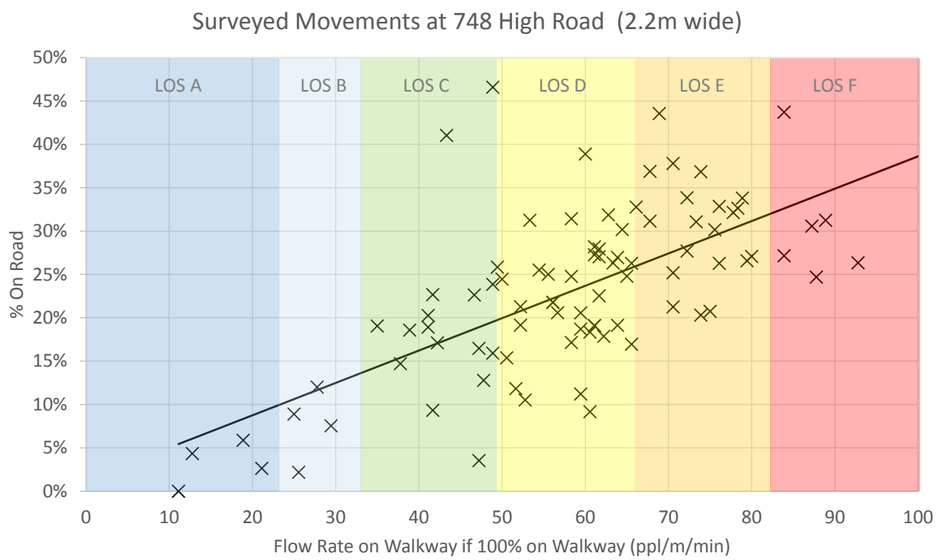


Figure 5 Percentage of pedestrians in road vs implied flow rate if all people on the footpath, outside 748 High Road

2.4.3 There was only one minute at the end of the survey period (shortly after the match had kicked-off) during which no people were observed in the road. The survey identified that people walked in the road at low flow rates.

2.4.4 The graph demonstrates a positive relationship between the flow rate on the footpath and the number of people who will walk in the road. However, from the information collected, it is impossible to establish a flow rate below which no people will walk in the road.

2.4.5 Outside 750 High Road

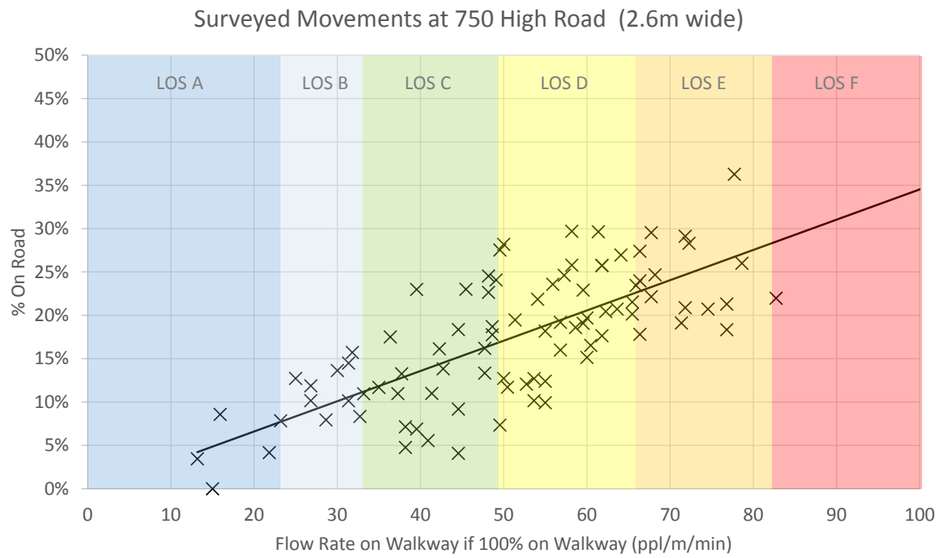


Figure 6 Percentage of pedestrians in road vs implied flow rate if all people on the footpath, outside 750 High Road

2.4.6 There was only one minute, two minutes after kick off, during which no people were observed in the road.

2.4.7 Again the graph demonstrates a positive relationship between the flow rate on the footpath and the number of people who will walk in the road.

2.4.8 The percentage of people in the footpath (width 2.6m) is higher than outside 748 (width 2.2m) at the same flow rates.

2.4.9 North of Paxton Road

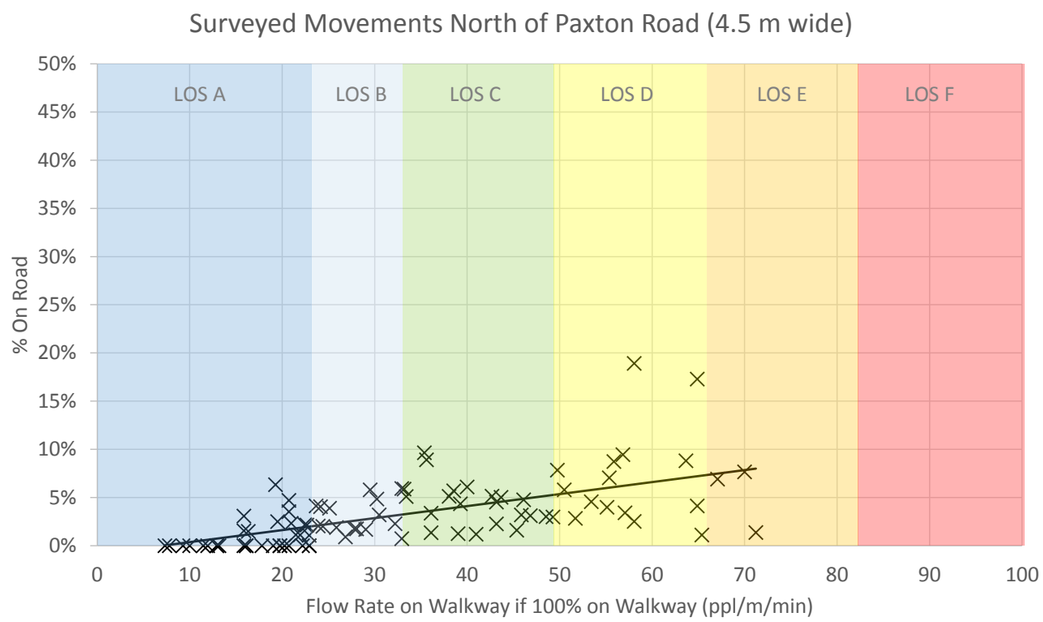


Figure 7 Percentage of pedestrians in road vs implied flow rate if all people on the footpath, north of Paxton Road

2.4.10 Across the 90 minutes surveyed there were 23 minutes during which no people were observed walking in the road. Almost all of these observations were outside the peak hour before kick-off. During the period 14:00-14:57 there was only one minute (at 14:22) during which no people were observed walking in the road.

2.4.11 There is a positive relationship between the flow rate and the number of people walking on the road.

2.4.12 The percentage of people in the road was lower than at 748 and 750 at the same flow rates.

2.5 Comparison of all three locations

2.5.1 Results from the three sites have been plotted on the same chart, with linear trend lines fitted to each to aid in comparison.

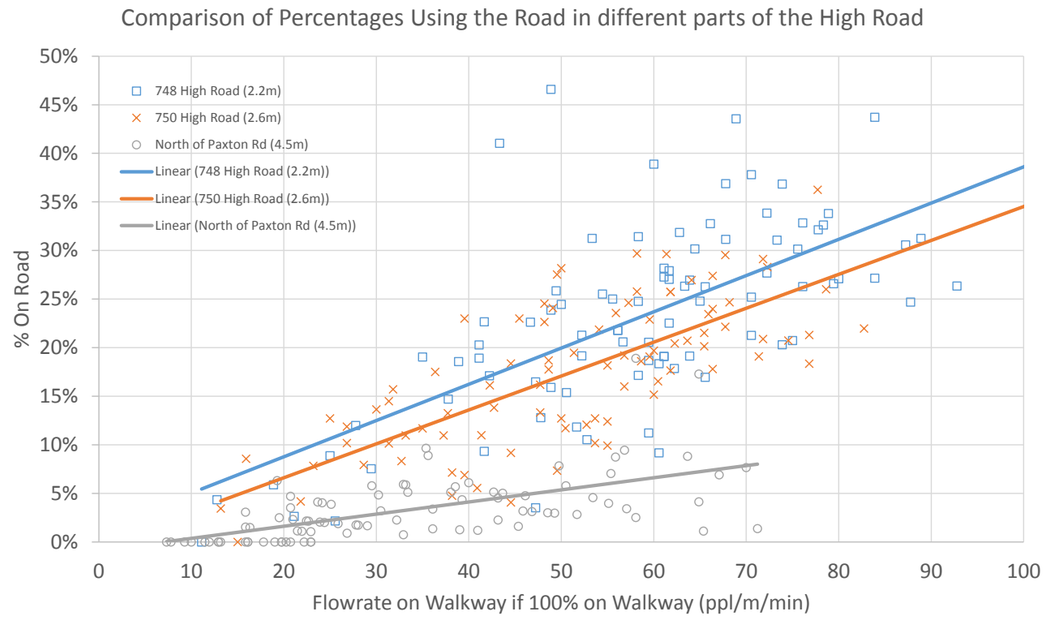

Comparison of Percentages Using the Road in different parts of the High Road
748 High Road (2.2m)
750 High Road (2.6m)
North of Paxton Rd (4.5m)
Linear (748 High Road (2.2m))
Linear (750 High Road (2.6m))
Linear (North of Paxton Rd (4.5m))
% On Road
Flowrate on Walkway if 100% on Walkway (ppl/m/min)

Figure 8 Comparison of flow rate on road and percentage in the road at the three locations.

2.5.2 As the width of the footpath increases, the percentage of people walking in the road decreases.

2.5.3 As the flow rate increases, the percentage of the people in the road increases.

2.6 Conclusions from the survey data

2.6.1 On the High Road approaching the stadium fans walked in the road even at low flow rates at all three sites.

2.6.2 The width of 4.5m north of Paxton Rd was not sufficient to encourage all of the fans to remain on the footpath.

2.6.3 Results from video surveys along the High Road demonstrate that:

- the proportion of people walking in the road increases as the flow rate increases;
- the narrower the pavement width the higher proportion of pedestrians who will walk in the road; and
- At narrow footpath widths pedestrians walk in the road even at low flow rates as there is little opportunity for them to manoeuvre past other pedestrians and remain on the walkway. This problem is exacerbated due to the number of spectators who arrive at the stadium in groups.

3.0 Crowd Flows

3.1 Safety Defining Appropriate Standards

3.1.1 The analysis of the current conditions experienced by spectators at the existing stadium identifies a significant risk to safety as a consequence of the number of spectators walking in the road in the period before matches.

3.1.2 The risk arises from the narrow, and narrowing, footpath along the High Road outside the buildings. There is insufficient space so that the pedestrians bypass slower moving pedestrians or avoid conflict - or anticipated conflict - with counter flows by stepping into the available space in the bus lane. The frequency of conflicts is increased in this situation by the presence of a high proportion of groups visiting the stadium, and the narrowing footpath that creates higher crowd densities.

3.1.3 Against this background THFC and its design team have sought to design the new stadium and its environs to reduce risks to spectators to be As Low as Reasonably Practicable ("ALARP").

3.1.4 "Making sure a risk has been reduced ALARP is about weighing the risk against the sacrifice needed to further reduce it. The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure.

3.1.5 To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices."[2]

3.1.6 This report assesses the proposed scheme against this objective, and considers whether it is feasible to reduce risks to ALARP while retaining the three locally listed buildings.

3.1.7 The starting point of the analysis is to consider appropriate flow rates at which the risk is reduced to ALARP.

3.1.8 This requires consideration of the concept of the Level of Service that pedestrian visitors to the stadium will enjoy. Level of Service relates the circumstances and conditions experienced by pedestrians (including whether they are likely to experience conflict) to flow rates and crowd densities.

3.1.9 It is necessary to consider both the flow rates at which there are few pedestrian conflicts and also whether the width of footway is sufficient to avoid conflicts even at low flow rates.

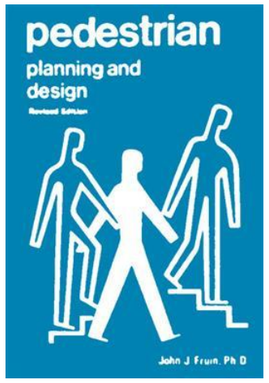
3.1.10 Our methodology for evaluation of the flow rates, Level of service, and whether there is sufficient clear width for flow in the various options has been to:

- Determine forecast for crowd flows (people/minute) during the peak 15 minutes in the vicinity of the stadium for the options being considered. The forecast is based on the Transport Assessment (which describes when and where people arrive into the area, what local facilities they use in the local area and the time profile over which they arrive in the immediate vicinity of the stadium); their ultimate destination in the stadium, and the use of the Club shop;
- Determine the effective widths of the walkways for the walkway under consideration by reducing the width to take account of obstructions in the walkways and edge effects;
- Determine flow rates (people/metre/minute) by dividing flows by the effective widths of the walkway;
- Relate flow rates to the conditions experienced by pedestrians (e.g., whether there are likely to experience conflict) using the concept of Level of Service; and.
- Determine whether this Level of Service is acceptable for the option under consideration.

3.1.11 We have then considered whether the options presented create other crowd safety risks arising from mitigation measures.

3.1.12 Two sets of guidance were considered in our crowd flow and safety evaluation.

3.2 Fruin Levels of Service



3.2.1 The Level of Service concept for pedestrian flow was developed by Professor Fruin, (described in Pedestrian Planning and Design, Fruin, 1971) and is the most widely applied basis of quantitative assessments of crowded places. The concept relates crowd density, flow rates and pedestrian experience. It forms the basis of standards applied in different types of buildings and places, particularly those applying to high crowd flow environments, for example London Underground's Station Planning Standards and Guidelines. The Guide to Safety at Sports Grounds guidance, published by the Sports Grounds Safety Authority, includes crowd densities and flow rates in its guidance.

3.2.2 Fruin describes six Levels of Service for walkways (as opposed to stairs or queuing areas) which are illustrated in Fig. 5 over the page.

Figure 9 Pedestrian Planning & Design, John J Fruin, 1971 available from Elevatorbooks.com

3.3 TfL Pedestrian Comfort Guidance for London

3.3.1 In 2010 Transport for London published its Pedestrian Comfort Level Guidance, 2010, to assist those planning London's streets to create excellent pedestrian environments. It can be downloaded from https://tfl.gov.uk/cdn/static/cms/documents/pedestrian-comfort-guidance-technical-guide.pdf.

3.3.2 Its focus is on the space needed to facilitate a successful street, in terms of comfort and experience, and therefore usage, rather than a focus on safety. Its guidelines apply to places that require more space than places designed for crowd flow (such as stadium vomitories). Its scope is equivalent to Fruin Levels of Service A to C, i.e., the more comfortable, lower flow rate environments.

3.3.3 As well as a set of Levels of Service (different and more generous in space/person terms than Fruin's) the Guidance includes more detail than Fruin of the real impact of street furniture based on measurements in London, and the recommended minimum widths for pavements.

[2] Health and Safety Executive website; http://www.hse.gov.uk/risk/theory/alarpglance.htm

Level of Service A

Flow rate: 0-23 p/m/min

Density: > 3.23 m²/person

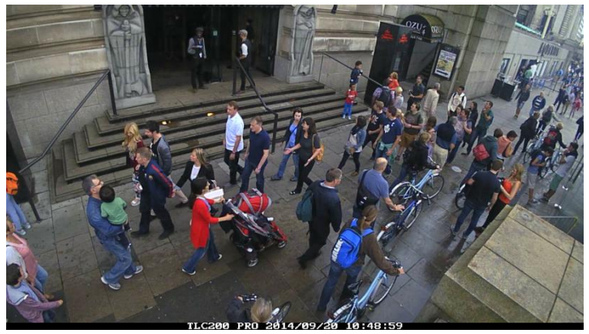
Normal walking speed can be freely selected and slower pedestrians can be overtaken easily.
Crossing conflicts can be easily avoided.

Level of Service B

Flow rate: 23-33 p/m/min

Density: 3.23 - 2.33 m²/person

Sufficient space is available to select normal walking speed and to bypass other pedestrians in primarily one-directional flows. Where there are reverse-direction or crossing movements, minor conflicts will occur.

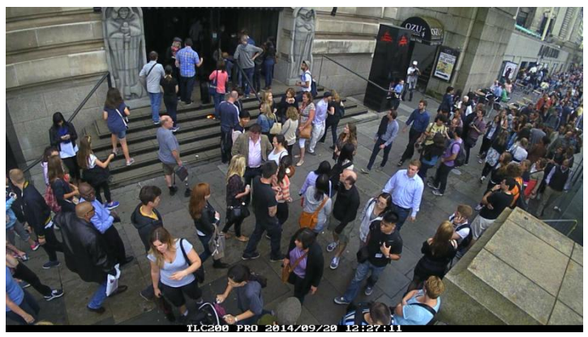


Level of Service C

Flow rate: 33-49 p/m/min

Density: 2.33 - 1.39 m²/person

Restricted ability to select normal walking speed and pass others. High probability of conflict where crossing movements and counter-flows exist. Conflict avoidance requires frequent adjustment of walking speed and direction. However flow is reasonably fluid.



Level of Service D

Flow rate: 49-66 p/m/min

Density: 1.39-0.93 m²/person

Restricted walking speed. Overtaking is difficult, cross-flows are restricted. There is some probability of intermittently reaching critical density, causing momentary stoppages of flow.

Level of Service E

Flow rate: 66-82 p/m/min

Density: 0.93 - 0.46 m²/person

Restricted walking speed and passing ability. Forward movement only by shuffling. Counter-flows and crossing movements extremely difficult. Flow volumes approach limit of walking capacity.

Level of Service F

Flow rate: restricted, lower than LoS E

Density: <0.19 m²/person

Severely restricted walking speed. Frequent contact. Cross-flows are virtually impossible. Pedestrian flow is sporadic & unstable.

Figure 10 Fruin Walking Levels of Service

3.3.4 MS has concluded from a consideration of Fruin that the appropriate target to reduce risk ALARP should be the limit of Fruin LOS A/B (if practicable) and otherwise LOS B provided there is sufficient footway width for minor conflicts to occur without the requirement to step off the pavement. Fruin states that at LOS B there is sufficient space to select normal walking speeds and to bypass other pedestrians in primarily one-directional flows, as is the case outside 746 – 750 High Road in some of the future schemes considered. However, conflicts would still occur considering the high prevalence of groups in a stadium crowd.

3.3.5 At LOS C there is a restricted ability to select normal walking speed and pass others, and consequently a high probability of conflict, and pedestrians will be likely to walk in the road.

3.4 TfL Pedestrian Comfort Guidance for London: Pedestrian Comfort Levels

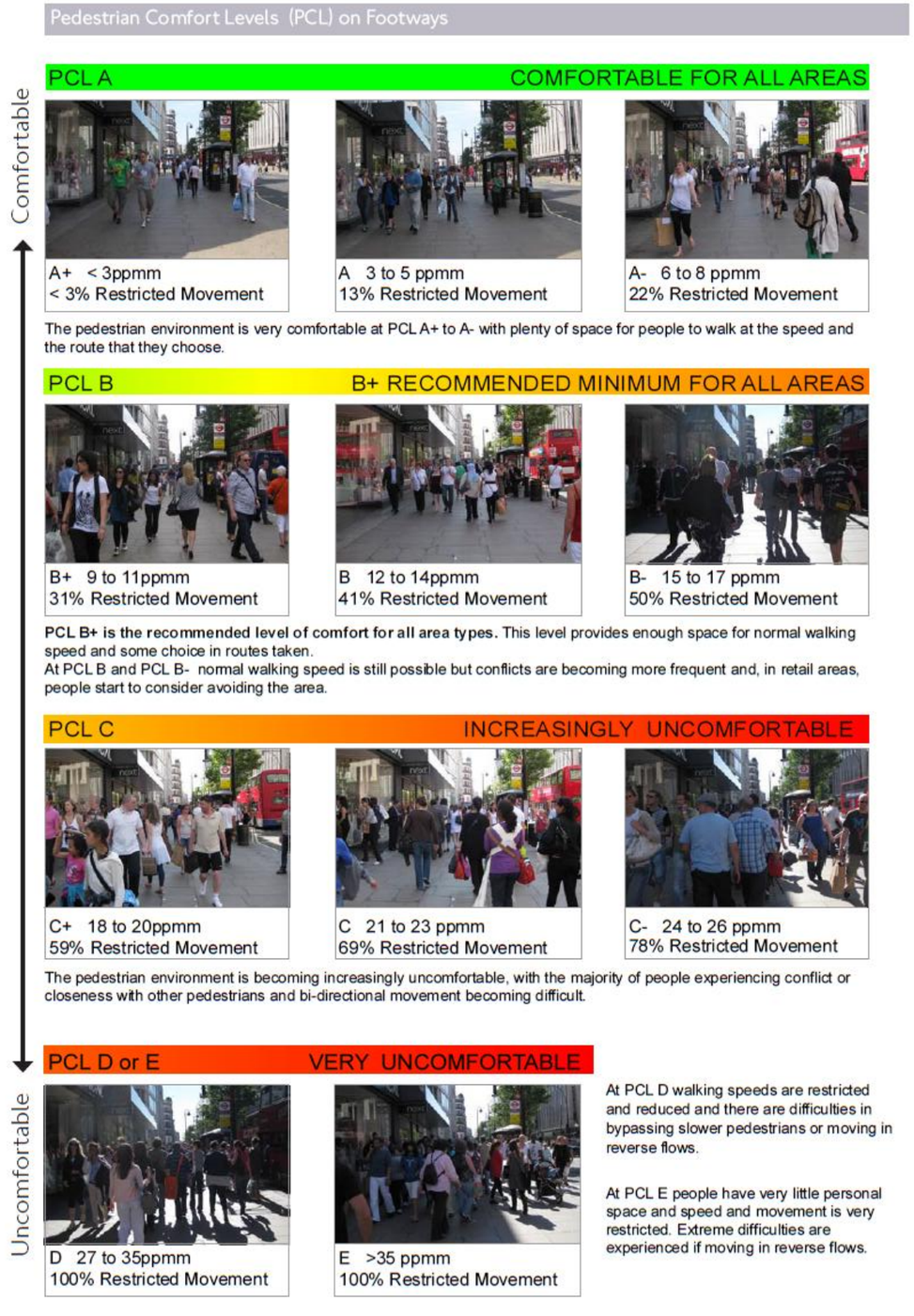

Pedestrian Comfort Levels (PCL) on Footways
Comfortable
PCL A
COMFORTABLE FOR ALL AREAS
A+ < 3ppmm
< 3% Restricted Movement
A 3 to 5 ppmm
13% Restricted Movement
A- 6 to 8 ppmm
22% Restricted Movement
The pedestrian environment is very comfortable at PCL A+ to A- with plenty of space for people to walk at the speed and the route that they choose.
PCL B
B+ RECOMMENDED MINIMUM FOR ALL AREAS
B+ 9 to 11ppmm
31% Restricted Movement
B 12 to 14ppmm
41% Restricted Movement
B- 15 to 17 ppmm
50% Restricted Movement
PCL B+ is the recommended level of comfort for all area types. This level provides enough space for normal walking speed and some choice in routes taken.
At PCL B and PCL B- normal walking speed is still possible but conflicts are becoming more frequent and, in retail areas, people start to consider avoiding the area.
PCL C
INCREASINGLY UNCOMFORTABLE
C+ 18 to 20ppmm
59% Restricted Movement
C 21 to 23 ppmm
69% Restricted Movement
C- 24 to 26 ppmm
78% Restricted Movement
The pedestrian environment is becoming increasingly uncomfortable, with the majority of people experiencing conflict or closeness with other pedestrians and bi-directional movement becoming difficult.
PCL D or E
VERY UNCOMFORTABLE
Uncomfortable
D 27 to 35ppmm
100% Restricted Movement
E >35 ppmm
100% Restricted Movement
At PCL D walking speeds are restricted and reduced and there are difficulties in bypassing slower pedestrians or moving in reverse flows.
At PCL E people have very little personal space and speed and movement is very restricted. Extreme difficulties are experienced if moving in reverse flows.

Figure 11 Transport for London's Pedestrian Comfort Guidance: Page Pedestrian Comfort Levels

3.4.1 Levels PCL A and B would meet the objective of reducing the risk of conflicts to acceptable levels. However PCL A and B are only achievable with very low flow rates which it is not practicable to achieve in the vicinity of a stadium.

3.4.2 A lower PCL rating will mitigate the risk ALARP provided that there is sufficient space and opportunity for pedestrians to avoid conflict without stepping into the road. A low rating would therefore require a sufficiently wider footpath.

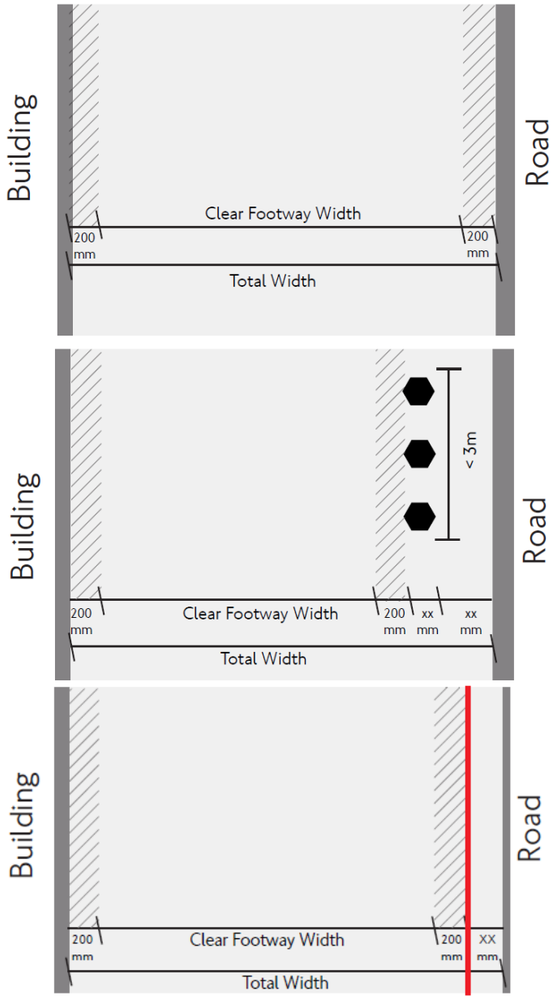
3.4.3 In these circumstances it is considered that an appropriate target to mitigate the risk ALARP is PCLC. PCL D and E will not mitigate conflicts sufficiently to reduce the risk to ALARP and are therefore unacceptable, without further mitigation to prevent people walking into the road.

3.5 Conclusion

3.5.1 From a consideration of both standards Fruin LOS A/B equivalent to PCL Guidance C has been identified with a target flow rate of 23p/m/min together with sufficient width in order to reduce the identified crowd safety risk to ALARP.

3.6 Usable widths of footpaths

The measured width of the footpath does not represent the effective width for considering crowd safety issues.



Where there is no street furniture or obstructions, the usable walkway width is the total width less a 200mm edge effect on each side. This accounts for people not wanting to walk too close to a building or kerb line.

Where there are bollards near the road side, the usable width is measured between the building and the bollards, less a 200mm edge effect on each side.

The bollards would be 200mm wide, and would be situated 450mm from the road edge, thus the total width reduction would be:

450+200+200+200 = 1050mm.

Where there are barriers or guard rails near the road side, the usable width is measured between the building and the barrier or guard rail, less a 200mm edge effect on each side.

Figure 12 Pedestrian Comfort Guidance on effective usable walkway width to calculate Level of Service

3.7 Minimum widths of footpaths

The Transport for London Pedestrian Comfort guidance copied in Figure 13 below suggests minimum widths for walkways. The forecast non-event weekday evening flow of 640 people per hour puts the current footpath outside 748 and 750 High Road into the Active Flow category. This would require a minimum of 3.3m, or 4.2m if there is street furniture present. Therefore the current footpath is not compliant with the Transport for London Guidance even on a non-event day.

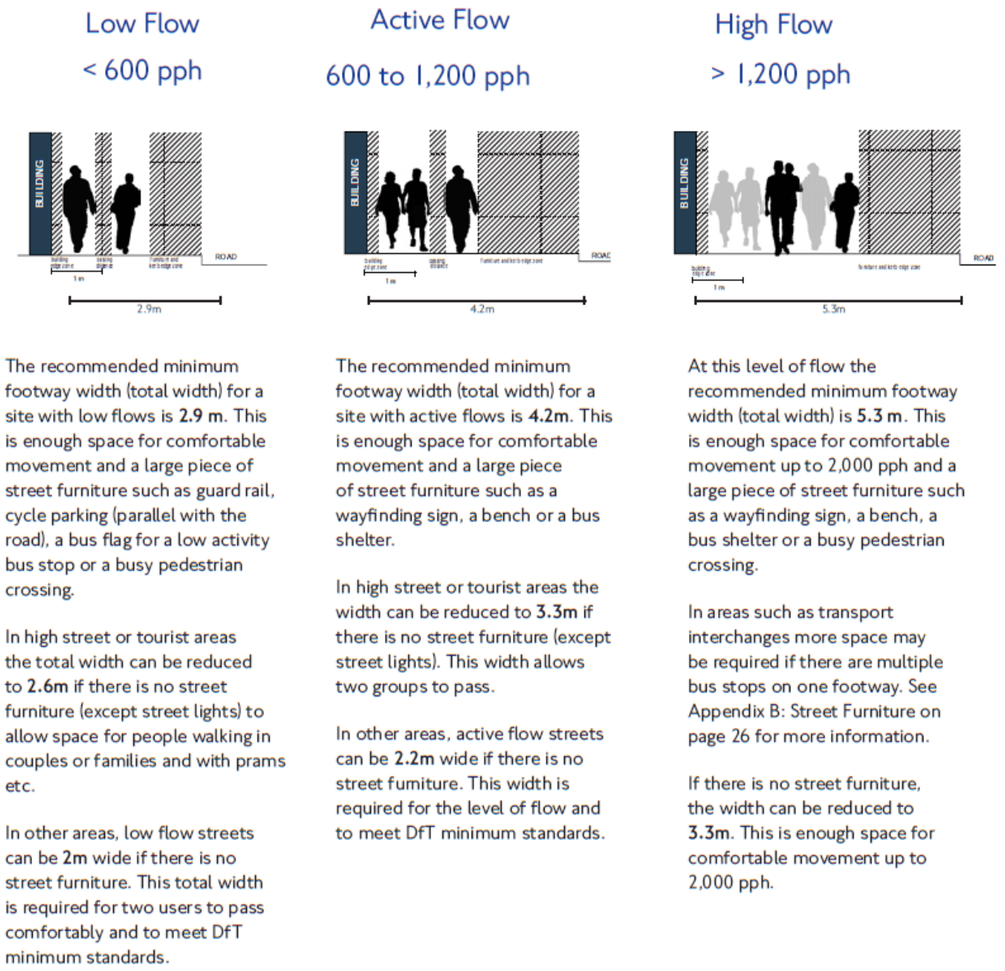

Low Flow
< 600 pph
Active Flow
600 to 1,200 pph
High Flow
> 1,200 pph
BUILDING
ROAD
2.9m
4.2m
5.3m
The recommended minimum footway width (total width) for a site with low flows is 2.9 m. This is enough space for comfortable movement and a large piece of street furniture such as guard rail, cycle parking (parallel with the road), a bus flag for a low activity bus stop or a busy pedestrian crossing.
In high street or tourist areas the total width can be reduced to 2.6m if there is no street furniture (except street lights) to allow space for people walking in couples or families and with prams etc.
In other areas, low flow streets can be 2m wide if there is no street furniture. This total width is required for two users to pass comfortably and to meet DfT minimum standards.
The recommended minimum footway width (total width) for a site with active flows is 4.2m. This is enough space for comfortable movement and a large piece of street furniture such as a wayfinding sign, a bench or a bus shelter.
In high street or tourist areas the width can be reduced to 3.3m if there is no street furniture (except street lights). This width allows two groups to pass.
In other areas, active flow streets can be 2.2m wide if there is no street fumiture. This width is required for the level of flow and to meet DfT minimum standards.
At this level of flow the recommended minimum footway width (total width) is 5.3 m. This is enough space for comfortable movement up to 2,000 pph and a large piece of street furniture such as a wayfinding sign, a bench, a bus shelter or a busy pedestrian crossing.
In areas such as transport interchanges more space may be required if there are multiple bus stops on one footway. See Appendix B: Street Furniture on page 26 for more information.
If there is no street furniture, the width can be reduced to 3.3m. This is enough space for comfortable movement up to 2,000 pph.

Figure 13 Transport for London Pedestrian Comfort Guidance Page 25: Recommended Widths

4.0 Evaluation of the Proposed and Approved Schemes

4.1 In this section we evaluate the Consented Scheme and the proposed Populous scheme against the identified standards and safety considerations.

4.1.1 This evaluation is based on estimates of the future crowd flows set out in the Major Event Day Transport Assessment 2015.

4.2 Flows considered in this analysis

4.2.1 The following crowd flows have been considered in this analysis

- General attendance spectator movements from transport hubs and local pubs to the stadium seating areas; and
- Flows to and from the Club shop.

4.2.2 The forecasts do not include any flows associated with:

- VIP Spectators who are considered to have entered the stadium outside the peak period; and
- Background pedestrian demand.

4.2.3 The flows do not consider the additional effects of the use of the three buildings for food and beverage uses. The reactivation of these buildings would only increase crowd flow in this area. In addition there would be an inherent conflict between the proposed use of the canyon for general spectator movements with people entering/leaving the buildings particularly if there are large numbers of people drinking outside. The proposed re-use of the three buildings is therefore only likely to act as a further deterrent from the use of the canyon and increase the crowd flow along the High Road in front of the buildings.

4.3 Time Profile

4.3.1 The Transport Assessment identifies a weekday evening kick-off as the worst case crowd flow scenario. A future forecast arrival for a weekday evening match is set out below.

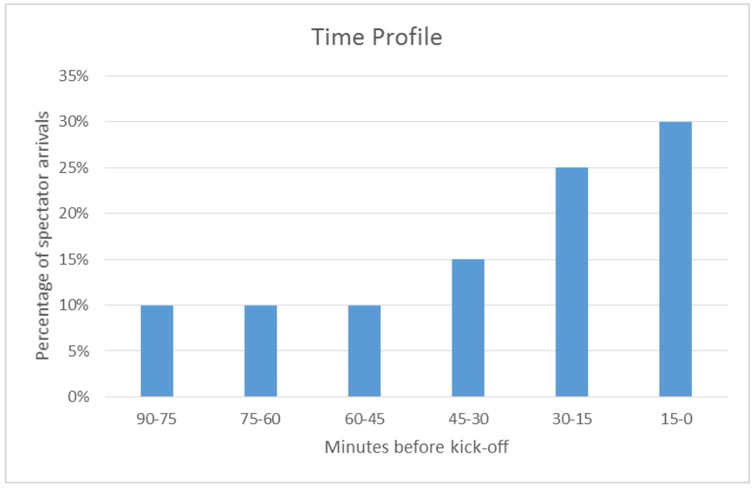


Figure 14 Future forecast arrival profile, Transport Assessment

4.3.2 The crowd flow analysis therefore focuses on the peak 15 minutes arrival during which 30% of people arrive. Figure 15 illustrates the peak flows arising in the Populous scheme.

4.4 The Populous Scheme

4.4.1 In order to reduce the risks arising from pedestrians moving into the road before a match the design has evolved by moving the Tottenham Experience east as far as possible while remaining consistent with the objectives of the scheme to maximise the available pavement width.

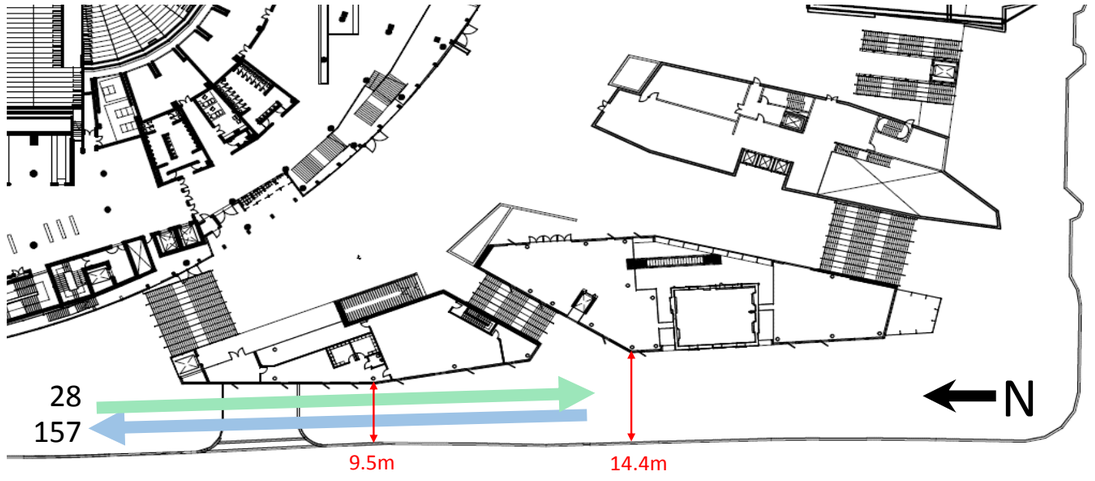


Figure 15 Forecast flows per minute past the bottleneck for the Populous Scheme

4.4.2 The forecast flow is 185 people per minute through the narrowest part of the footpath, which is 9.5m wide. This includes flows for access to and from the Club shop.

4.4.3 The scheme has bollards set back 0.45m from the edge of the road to allow for vehicle overhangs in accordance with the Manual for Streets. The bollards themselves would be 0.2m wide. A further 0.2m is subtracted from the effective width on the inside edge of the bollard and on the building edge. Thus the effective width is 8.45 metres wide.

4.4.4 In addition to this clear width, sited 0.85 metres from the road, there is an additional width between the road and the walkway. This increases the safety of the footpath as people would have to walk more than 0.85m outside of the effective clear width to be within the road.

4.4.5 With the forecast flow of 185 people per minute, the predicted flow rate would be 22 people per metre per minute.

4.4.6 This achieves the target flow rate of 23 people per metre per minute and the desired Fruin Level of Service A, and Pedestrian Comfort Level C. Taken with the increased width of footway, so that any manoeuvring is away from the walkway edge, the Populous scheme therefore reduces the crowd safety risk to ALARP.

4.5 The Consented Scheme

4.5.1 The Consented Scheme has been tested on the same basis. This assumes the retention of the three buildings, and the provision of a 'Canyon' to the rear of the buildings which is intended to divert flows away from the recognised pinch point along the High Road.

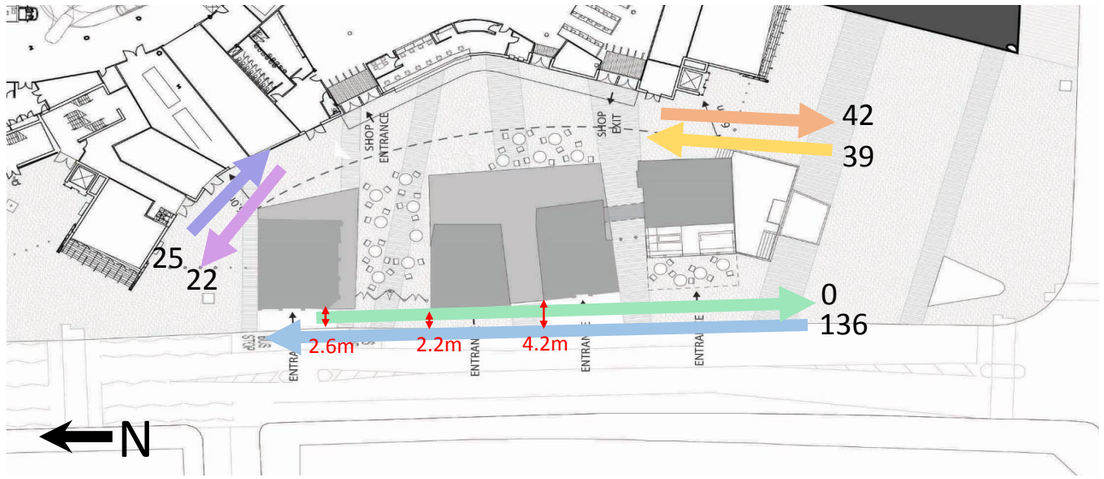


Figure 16 Forecast Flows per minute in the Consented Scheme

4.5.2 It is first necessary to identify the effective width for the Consented Scheme.

4.5.3 In the Consented Scheme, security bollards will be sited between the three buildings rather than between the locally listed buildings and the roadway.

4.5.4 The effective width in front of:

- 746 High Road is 3.8m
- 748 High Road is 1.8m
- 750 High Road is 2.2m

4.5.5 The forecast flow between Park Lane and the north of 750 High Road is 136 people per minute. Although this is shown as one-way, in practice there would be a small amount of contraflow similar to the survey North of Paxton Rd (see section 1).

4.5.6 A further 47 people per minute (25 + 22 p/min) would move between the north and the Club shop. Thus the combined flow to or from the north would be 184 people per minute. 81 people per minute (42 + 39 p/min) would move between the south and the Club shop. Thus the combined flow to or from the south of the stadium is 218 people per minute.

4.5.7 Based on the forecast flows and effective widths, the predicted flow rate in the Consented Scheme (in front of 746-750 High Road) is 76 people per minute per metre equivalent to Fruin Level of Service E. At this flow rate pedestrians are certain to walk in the road. The Consented Scheme does not therefore reduce risk to ALARP.

4.5.8 In order to achieve Level of Service A (23 people per metre per minute) the Consented scheme would need to provide a minimum footpath width of 6.4 metres – close to three times the width actually provided.

4.5.9 The above analysis assumes no general pedestrian movements through the canyon.

4.5.10 If some flows are diverted into the canyon, as was originally anticipated, the crowd flows on the footpath in front of the three buildings would decrease by the same volume to the level of flow through the canyon.

4.5.11 It is therefore necessary to consider the likelihood of general crowd movements through the canyon.

4.5.12 The route through the canyon is longer than the route along the High Road, without a clear line of sight to the end location, and off the desire line. There is no reason for spectators to do this unless they wish to wait for friends entering the Club shop or visiting the possible food and beverage outlets in the three buildings.

4.5.13 The additional flows generated by the reoccupation of the three buildings for food and beverage uses have not been taken into account in this assessment. In accordance with the commercial advice of DCL, the occupier demand for these units would be dependent on having outdoor areas for drinkers and smoking.

4.5.14 Furthermore the volume of demand for these units is likely to be high, and is effectively unconstrained. This presents a further problem of how to manage high volumes of spectators congregating in the canyon and the High Road. Access to the units and queuing would need to be managed so as not to have crowds creating congestion in the canyon. It would be difficult for this to be managed to allow the scheme to operate as intended.

4.5.15 As a consequence, the reuse of the three buildings would create additional flows and groups of spectators gathering to drink and/or waiting for friends which in turn would represent a further significant constraint to free flows through the canyon – acting as a deterrent.

4.5.16 Two examples showing the importance of designing for the desire line are shown below. Even in the case of very minor diversions, the evidence demonstrates that people will take the most direct route.

Figure 17 Design vs User Experience: the design needs to cater for the desire line

4.5.17 A further football example is the informal path created by fans approaching the Emirates Stadium through, Highbury Fields. These fans follow their own desire line, rather than the longer formal route on the path around the park, off the desire line. It is highly likely that a similar pattern would arise in the Consented Scheme.

Figure 18 Spectators on their way to Emirates Stadium in Highbury Fields

Figure 19 Satellite Imagery from Google Earth showing route across Highbury Fields

4.5.18 Against this background the canyon will not sufficiently reduce crowd flow in front of the three buildings.

4.5.19 In order to achieve the target flow rate, 70% of the crowd flow would have to deviate through the canyon. For the reasons set out above MS do not consider that there is a realistic prospect of this percentage of pedestrians chosing to use the canyon.

4.5.20 By way of direct comparison as set out above it is predicted that the Populous scheme will achieve a flow rate of 22 people per metre per minute.

4.5.21 For the Consented Scheme to achieve the same flow rate as the Populous Scheme 71% of the crowd would be required to use the canyon.

4.5.22 Even in the unlikely event that this level of diversion could be achieved, the Consented Scheme would not be as safe as the Populous scheme for the following reasons:

- At low widths people are more likely to manoeuvre round others by walking in the road
- There is a smaller physical margin at the walkway - road boundary – and not marked by bollards
- There is less scope for futher mitigation – this is explored in the options assessment.

4.5.23 In conclusion it is MS's opinion based on these assessments that the Consented Scheme would not achieve the target flow rate and Level of Service necessary to reduce the volume of pedestrians walking in the road and would not therefore reduce the crowd safety risk to ALARP.

4.5.24 Furthermore it is MS's opinion backed up by empirical evidence and TfL Comfort Guidance that the 2.2m width provided in the Consented Scheme would be too narrow to be ALARP for a new stadium.

5.0 Alternative Options

5.1 Having concluded that the Consented Scheme would result in unacceptable crowd safety conditions, the team has examined alternative options to seek to retain the three buildings, to deliver the required levels of service and comfort levels, and to reduce risks to ALARP.

5.2 On the basis that our starting point has been to try to retain all the NDHA, the range of options tested is largely based upon the consented scheme, and how this could be adapted to make this scheme acceptable in crowd safety and transportation terms. We have also considered the viability and deliverability of each option.

5.3 The list of options is broadly in ascending order of physical intervention. The options analysed are in summary:-

1. The Consented Scheme with no crowd management
2. The Consented with barriers and stewarding and policing
3. The Consented Scheme with temporary closure of the Southbound bus lane
4. The Consented Scheme with permanent closure of the Southbound bus lane
5. The Consented Scheme with the temporary closure of both Southbound lanes
6. The Consented Scheme with the temporary closure of both Southbound lanes and contraflow on the Northbound carriageway
7. The Consented Scheme moving High Road westwards
8. The Consented Scheme and shared surface on the High Road
9. The Consented Scheme with a tunnel the High Road
10. The Consented Scheme and Flyover above the High Road
11. The Consented Scheme and pedestrian Bridge/walkways over the three buildings
12. The Consented Scheme with an increased Podium
13. The Populous Scheme

5.4 The more radical options raise very significant issues in terms of their impact on viability, deliverability, programme, and ultimately in some cases are likely to cause significant harm to other heritage assets, but are included for the sake of completeness. A full evaluation of each option is set out in section 8.0.

6.0 Viability and Deliverability

6.1 In parallel with the review of technical flow and crowd safety issues THFC has considered the viability and deliverability of alternative options to retain the three buildings.

6.2 The delivery of the new stadium is a critical component of the wider regeneration strategy for the area, and in particular the requirements of THFC and the NFL. Any significant delay to the delivery of the scheme would severely prejudice the wider regeneration aspirations held by LB Haringey, the GLA and central government.

6.3 Notwithstanding these wider issues, the practical impact of retaining the three buildings requires careful consideration in the light of the detailed crowd flow analysis.

6.4 This report should be read in conjunction with the addendum report prepared by Davis Lyons Coffer, which considers the commercial viability of the reuse of the three buildings. The most appropriate, and only viable commercial use identified is for food and beverage uses.

6.5 The report sets out how the ground floor areas of each of the buildings would need to be accessed and arranged (including the need for associated outdoor space) in order to accommodate the requirements of food and beverage operators.

6.6 The provision or external spaces to the rear would have a significant impact on the canyon, which already represents a narrow space, illustrated by the section below.

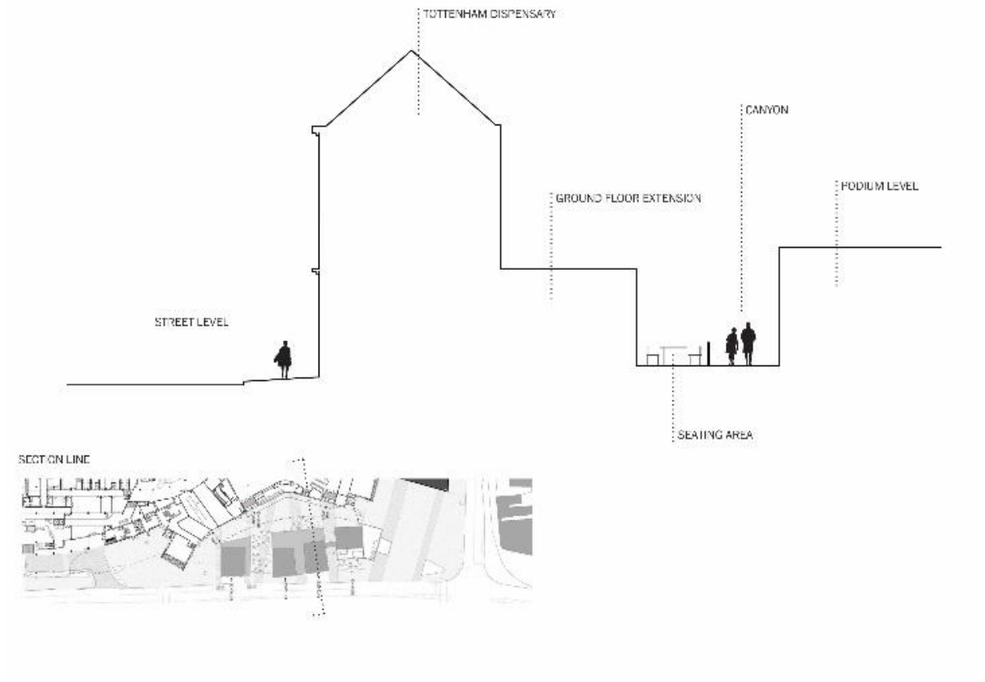


Figure 20 Cross-section showing the canyon

6.7 The way the buildings would need to be operated in order to accommodate viable uses has a material impact upon some of the options considered in the assessment, including for example:

- Any entrances to these buildings on the High Road would create additional flows through the existing constraints, and would create new counter- and cross-flows, both of which would exacerbate congestion, including on non-match days;
- On match days any crowds waiting or assembling outside entrances on the High Road would restrict flows and need to be managed (which would itself create congestion) to prevent people spilling into the road or further into the carriageway, which would be difficult to achieve;

  As a consequence, any entrances on the High Road would have to be closed on match days reducing commercial viability;
- External spaces and entrance/exits to external spaces in the canyon could be provided. However, these spaces (and therefore capacities) would have to be limited and contained to avoid congestion in the canyon. Severe congestion in the canyon would prevent spectators' access the stadium or the Club shop, and even less than severe congestion (including queuing for F&B) would encourage use of the High Road through the pinch point. Management controls would be needed to control access and any queuing in the event that demand is high, and it would be difficult in practice to prevent congestion for commercially successful F&B uses.
- On non-match days entrances / exits on the High Road would create cross-flows in a narrow pavement, which may push people into the road, when it is not expected by drivers of vehicles and buses. We have considered whether entrances on the High Road would be viable on non-match days for the options;

6.8 There is a fundamental conflict between the retention of the three buildings for their optimum (and only) viable use, and achieving acceptable crowd conditions which reduce risks to ALARP.

6.9 The evidence suggests that either the buildings would fail to attract occupiers capable of operating within the constraints imposed on the buildings and/of the reuse would lead to unacceptable risks to public safety.

6.10 The closure of the bus lane and southbound lanes of the High Road would lead to significant traffic and highways issues, outlined in the following section.

6.11 The delays and uncertainty associated with seeking such controls, given the limited justification and wider impacts arising, would seriously affect the programe and delivery of the stadium and wider regeneration of the area.

6.12 The more radical options, involving the relocation of the High Road, provision of a tunnel/flyover or elevated bridge would all impose significant additional costs and delays on the scheme, even if feasible. The viability of the Project is marginal at present, and as a consequence any additional costs associated with such major infrastructure works would make the scheme unviable and unfundable.

6.13 Furthermore, even if a sound technical case could be put forward for such measures, the costs, delays, uncertainty and traffic and heritage impacts of those proposals would be entirely disproportionate to any benefits realised.

6.14 In practice, none of these options would be viable or deliverable. The only option which is deliverable, acceptable in highways terms, and which reduces risk ALARP is the Populous Scheme.

7.0 Transport

7.1 The preceding chapters explain the crowd safety risk that will arise in the Consented Scheme.

7.2 The assessment of any alternative proposal to resolve this issue needs to consider the impact on the transport strategy for the new stadium and the wider highway network.

7.3 The transport strategy is complex and relies on the full exploitation of the transport services on the High Road and in the Tottenham area generally. The stadium is being actively promoted as a 'Public Transport Destination'. On major event days there will be extensive parking controls in both Haringey and Enfield that will oblige spectators to switch to more sustainable transport modes. THFC has set a modal split target of 77% of football spectators arriving in the vicinity of the stadium by non-car modes.

7.4 The only compromise to this strategy is that the High Road is closed to all traffic during the busiest part of the post-event dispersal period.

7.5 The crowd safety issue that is the subject of this report therefore exists solely in the pre-game situation. Consideration has been given to the feasibility of closing the High Road before a match to seek to resolve the crowd safety issue.

7.6 After the match the auditorium is empty 10 minutes after the final whistle and only small numbers of spectators will remain in the building – mostly those enjoying corporate entertainment. Although one of the aspirations of the Stadium Travel Plan will be to retain a greater percentage of spectators in the stadium for a longer period after the end of the match.

7.7 The majority of spectators disperse from the local area very quickly and therefore the High Road is able to be re-opened 30 minutes after the final whistle depending upon advice from the police.

7.8 There is an unavoidable requirement to close the High Road for a short period to allow the spectators to disperse because of the location of the stadium immediately adjacent to a Strategic Road. This closure results in significant local traffic congestion which often takes an hour to clear.

7.9 In contrast before a match the stadium area becomes progressively busier over a longer time period – 90-120 minutes before kick-off depending on the day of the game and its significance. The issues of pre match crowd management and safety are compounded by spectators arriving, meeting, and drinking in the vicinity of the stadium before the game.

7.10 The closure of the High Road for a short 30 minute period before kick-off (replicating the position after a game) would not therefore resolve the crowd safety issue. In practice the High Road would need to be closed for a considerably longer period – likely to be at least two hours before a game.

7.11 The temporary road closure after the game requires the implementation of bus and general traffic diversion routes. The post-match closure is implemented 5 minutes before the final whistle and is easy to implement because the traffic and pedestrian levels at that time are generally quite low – in contrast to the situation before a game. These bus and general traffic diversion routes would need to be implemented before a match.

7.12 The existing bus diversion after the game takes the services a mile away from the stadium which is very inconvenient for general travellers and means that there are no post-match bus service available in the High Road corridor for spectators.

7.13 Whereas the current post match all-traffic diversion might only apply for 30 minutes after the final whistle, the buses divert to the east side of the stadium well in advance and don't return to a full service for over 1 hour after the game.

7.14 In all likelihood if the road was closed pre-match (together with the existing post-match diversions) the buses would never return to the High Road for the period between the closures.

7.15 In practice the bus diversions are likely to be operate for at least 4 hours every event day.

7.16 This would have significant implications for spectators, local residents reliant on these services as well as travellers using these routes to travel longer distances on the network but who would ordinarily pass through this stretch of the High Road.

7.17 Any proposal to close part or all of the High Road before a game, could result in traffic congestion over an extended period in the approach routes to the stadium. This congestion would arise at a time when the stadium is fully occupied and in the worst-case situation could persist for the full duration of the of the road closure – potentially over 4 hours.

7.18 This traffic congestion would result in disruptions to access to the stadium by emergency service vehicles. All 3 emergency services would be equally disrupted which would be a significant concern for the Stadium licensing body (Stadium Advisory Group as led by LBH Building Control). There will be a number of ambulances stationed on site but they could only deal will a small incident.

7.19 There will also be a police vehicle presence but those vehicles would need to be able to quickly move around the area to respond to calls for assistance. Fire tenders do not sit on site because they respond to calls from the fire station base and different incidents require different response vehicles.

7.20 Included below are two key plans which are proposed to be implemented with the new stadium to minimise the disruption caused by the short-term post-match closure of the High Road. The east side diversion for buses and general traffic is much shorter than the existing west side diversions by between 1 and 3 km. However, both would result in significant additional disruption.

7.21 The first priority is to divert buses by as little as possible in terms of travel distance and for the least possible time. Highway improvement works have been completed at the High Road junctions at Northumberland Park and Lansdowne Road to make the diversions possible in terms of the vehicle swept paths.

7.22 If the diversion was also to be pre-match the precise timings would determine the management strategy. However it would never be advisable to divert HGV's into what are residential areas.

7.23 If large number of cars were diverted to the east side over an extended period it would cause significant congestion for the diverted buses, which would defeat the object of the strategy.

7.24 The implementation of these proposed measures for the extended period would not therefore satisfactorily resolve the likely impacts on the wider transport network caused by the pre-match closure.

7.25 As a result the closure of part or all of the High Road before a game is likely to both prejudice the transport strategy for the stadium and adversely impact upon the wider highway network.

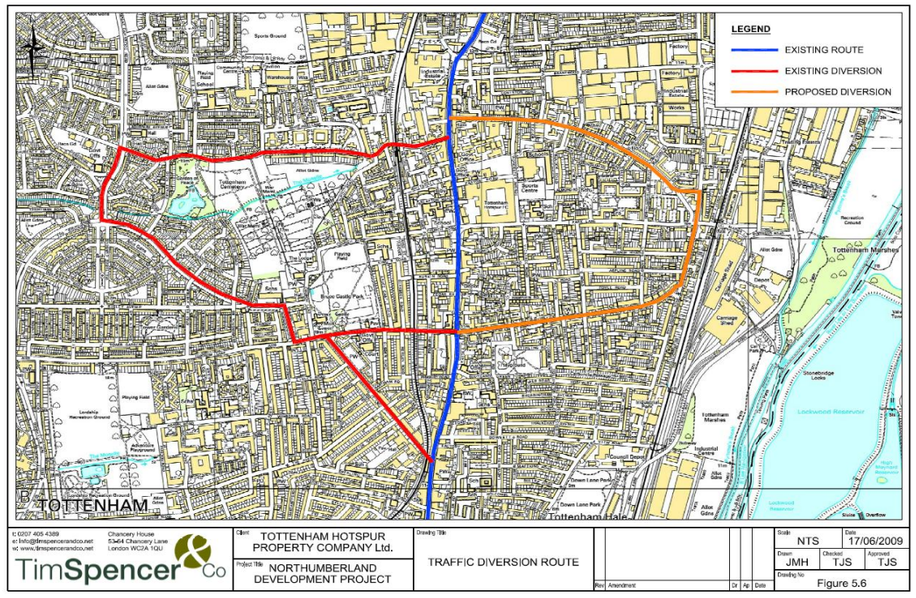


Figure 21 Traffic Diversion Routes

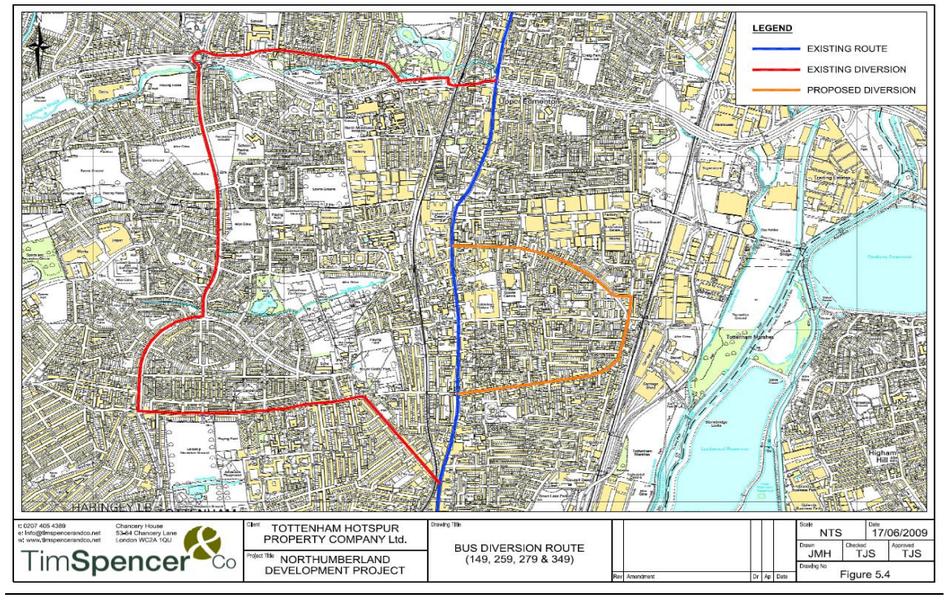
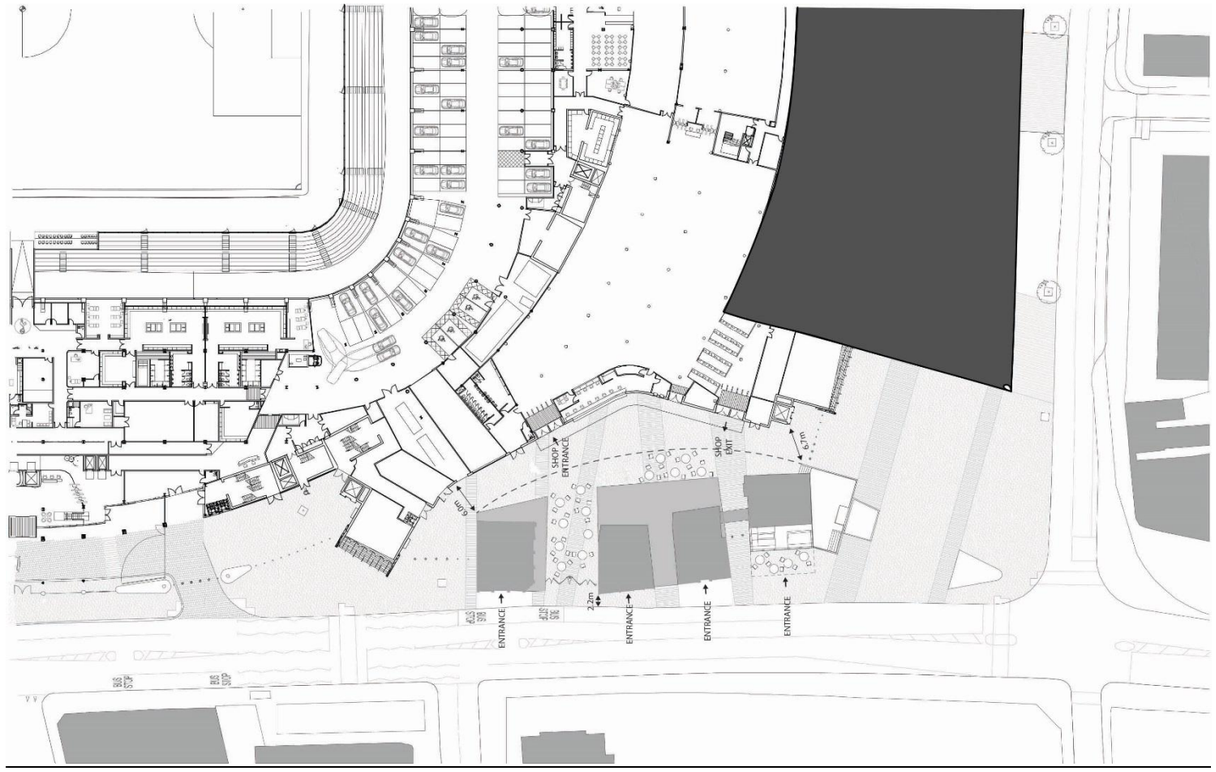
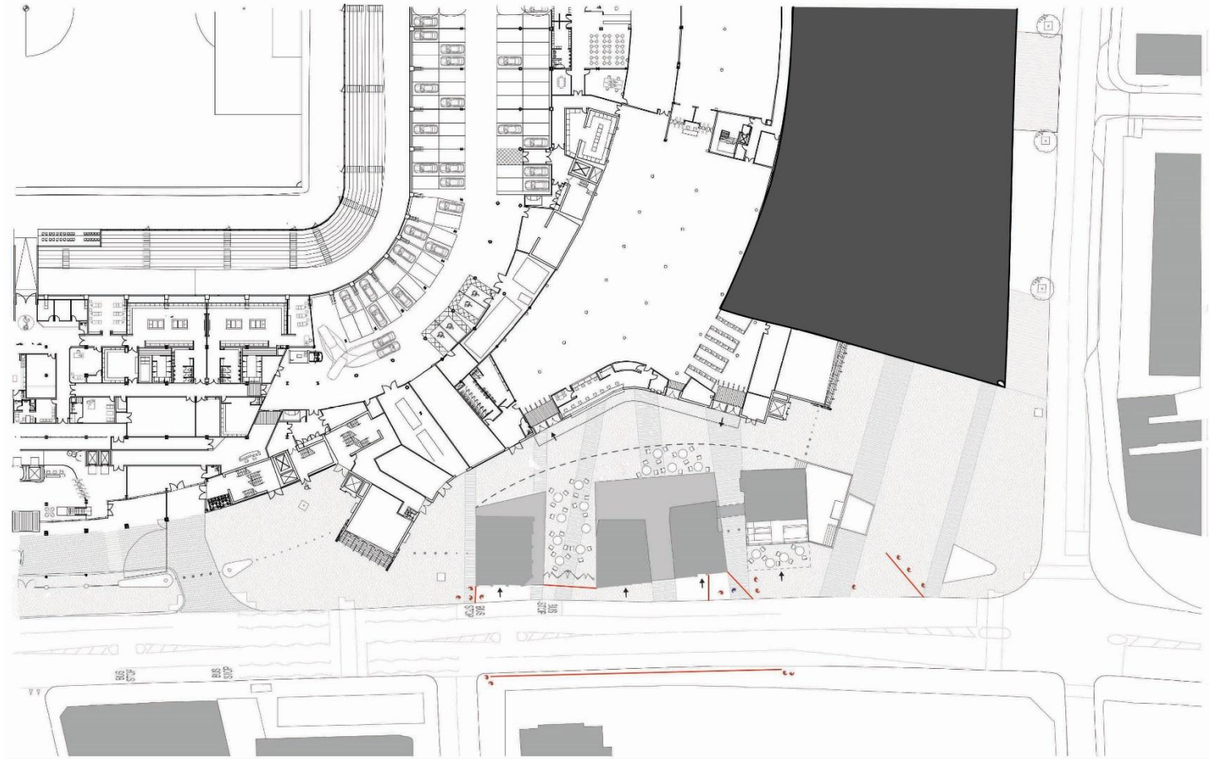


Figure 22 Bus Diversion Routes

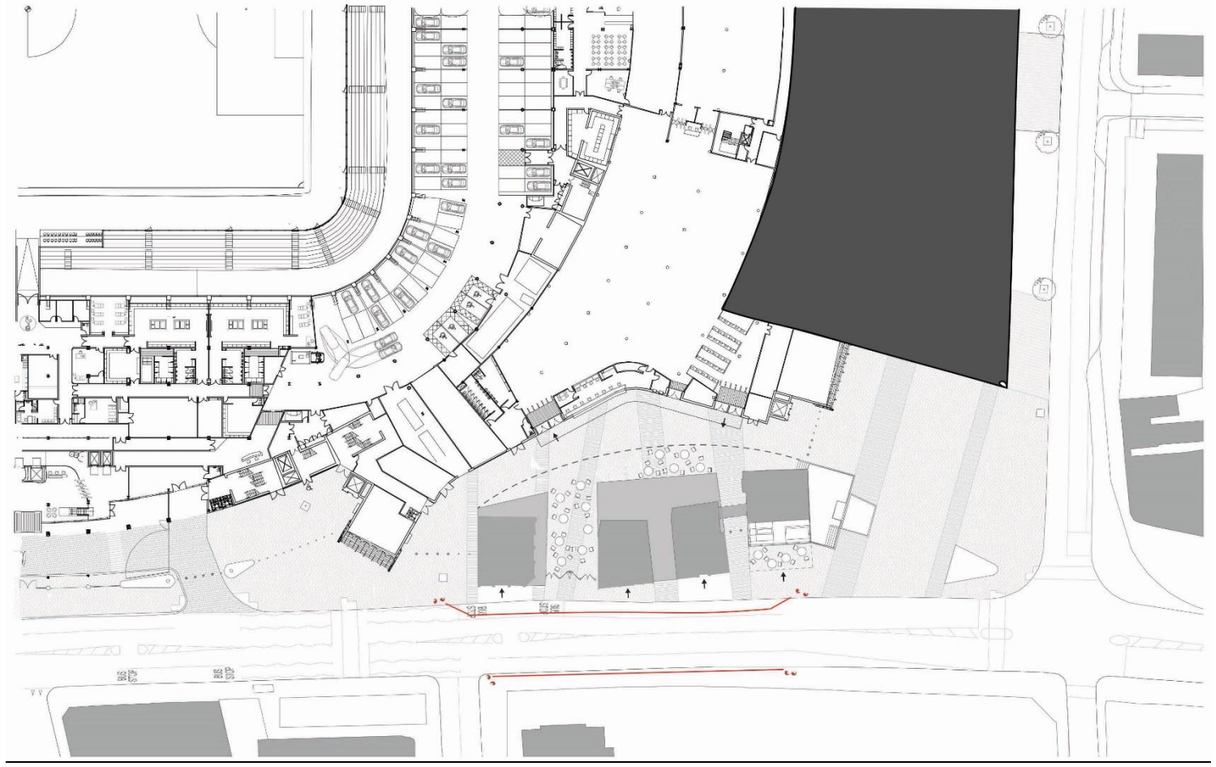
8.0 Evaluation of Each Option

1. KSS Consented Scheme with No Crowd Management	Assessment
OPTION SUMMARY • The consented KSS scheme (HGY/2010/1000) with no additional crowd management. 	**CROWD SAFETY** **Assessment against Target Flow Rate:** The forecast for the flow per minute for the peak 15 minutes between Park Lane and the north of 750 High Road is 136 people per minute, (which excludes the flows for the Club shop), although this forecast excludes any demand created by provision of Food and Beverage. This scheme is predicated on fans moving through the 'canyon' behind 744 - 750 High Road. Assuming no diversion through the canyon and the flows along the High Road through a 2.2m width (1.8m considering edge effects) gives a flow rate of 76 people/metre/minute (Fruin LOS E). At this flow rate pedestrians will be certain to walk in the road. However, the spectators' desire line and shortest route is along the High Road, and most will continue to use that route. It would require 70% of forecast match day flows to divert through the canyon to achieve LOS A/B. It is very unlikely that this level of diversion would be achieved. The scheme will not therefore achieve the objective of reducing risks to pedestrian safety to ALARP. If the three buildings are used for Food and Beverage retail then entrances/exits cannot be retained on the High Road on match-day due to increasing demand, congregation and cross flows on the High Road. If access is provided to the rear than the external areas - and the capacity - of the three buildings would have to limited and contained, to avoid congestion in the canyon. Access to the buildings via the canyon, and queuing outside the buildings would have to be controlled to prevent high volumes of spectators gathering outside the F&B units, and this would be difficult to achieve. This could block circulation through the canyon and access to the Club shop. Management of over-demand for the F&B units at the entrances to the canyon, while allowing access and circulation, would also be difficult to achieve. The re-use of the buildings will also increase crowd flows and congestion in the canyon, which will deter pedestrians from using that route. **Additional safety issues:** The kerb edge is a trip hazard which adds the possibility of slip/trip/fall. Even if the target flow rate was achieved the narrow footpath width means that pedestrians will step into the road to avoid conflicts made more likely by the presence of groups of spectators. The width at the pinch point is less than recommended by the TfL Comfort Guidance section 3.6 (minimum 3.3m) for an 'Active flow' environment (>600p/hr; 10p/min).

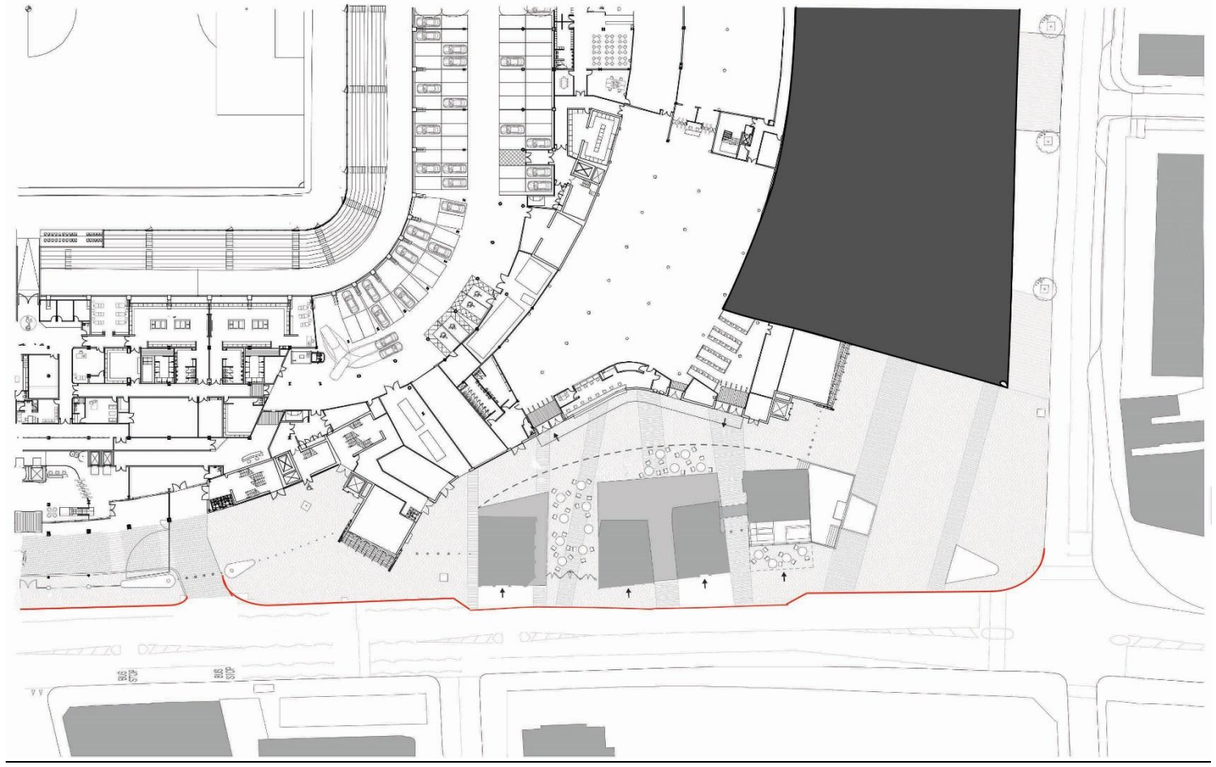
	HIGHWAYS AND TRANSPORT The existing southbound bus stop would need to be relocated further north perhaps to a point in front of the west side corporate spectator access or be removed without replacement.
	DELIVERABILITY This option depends on securing suitable occupiers for the three buildings. The optimum, and only viable use will be for F&B, and this use is dependent on match and event day trade. DCL advise that the units are currently too small to attract F&B operators (the only potential commercial occupier) without external space. The Crowd Flow Analysis demonstrates that entrances on the High Road are not viable in the base KSS option because of conflicts with crowd flow. They would exacerbate an already unacceptable and unsafe situation. External space in the Canyon will need to be limited and contained, with access managed and any queuing tightly controlled, which is likely to be difficult with risk that it cannot be achieved. This will impact upon the viability of the three buildings.
	CONCLUSION The scheme will not work as intended, with most pedestrians expected to continue using the High Road rather than the canyon and therefore not achieve the objective of reducing risks to pedestrian safety to ALARP. The footway width at the pinchpoint is less than recommended by TfL. 746-750 High Road do not appear viable.

2. Consented Scheme with Barriers & Stewarding & Policing	Assessment
OPTION SUMMARY • Consented scheme with insertion of physical barriers on eastern and western pavements enforced by stewarding and Policing to close stretch of pavement between 746 and 750 High Road. • Formalise non-use of 'bus lane'. 	**CROWD SAFETY** This management solution requires compliance from spectators and successful management over the lifetime of the project. It contemplates 100% of the crowd flow using the canyon. The predicted flow through the canyon in this option is 218 people/minute people, which includes football spectator flows associated with the Club shop (although flows for the Club shop during a NFL match are likely to be higher). The Canyon is 6.7m wide less 0.4m edge effect. The predicted flow rate per metre is therefore 35 people/metre/minute representing LOS C. Furthermore, this flow does not include any crowd flows or congregation associated with the use of three buildings for F&B. Access to the buildings from the High Road would be blocked on match day in this option. The external areas - and the capacity - of the three buildings would have to limited and contained, to avoid congestion in the Canyon. Access to the buildings via the canyon, and queuing outside the buildings would have to be controlled to prevent high volumes of spectators gathering outside the F&B units. This could block circulation through the canyon and access to the Club shop. Management of over-demand for the F&B units at the entrances to the canyon, while allowing access and circulation, would be difficult to achieve. In any event spectators and other pedestrians will want to follow their natural desire line. It will be difficult to achieve 100% compliance of spectators and other pedestrians using the canyon. It is very likely that some pedestrians will try to walk round the barriers, or move along the High Road from before the barrier line to bypass the system, or cross in the road demarcated by the barrier line. When this occurs therefore will be a higher risk for the individuals than exists currently or as proposed in the Consented Scheme, as non-compliant spectators will have their attention focused on stewards rather than vehicles. Vehicle drivers will not expect pedestrians in the road, and stewards and police would also be at risk of conflict with vehicles if they step out to block the paths of non-compliant spectators. Even if 99% of spectators comply approximately 68 people will be in the road outside these buildings during the ingress period before each match. The eastern footpath closure may cause increased use of the western footpath. Any people that choose to walk road-side of the western barrier there would find themselves stuck between vehicles and the barrier. It will not be apparent to pedestrians why the diversion is necessary increasing frustration for people that have to walk further. Police and stewards would be instructing people to walk the long way around, off their desire line, and away from the path they can see goes where they want, to one with limited visibility. This may lead to some frustration/aggression from spectators in conflict with Police and stewards. If the solution is not successful, the risk is built-in for the lifetime of the stadium.

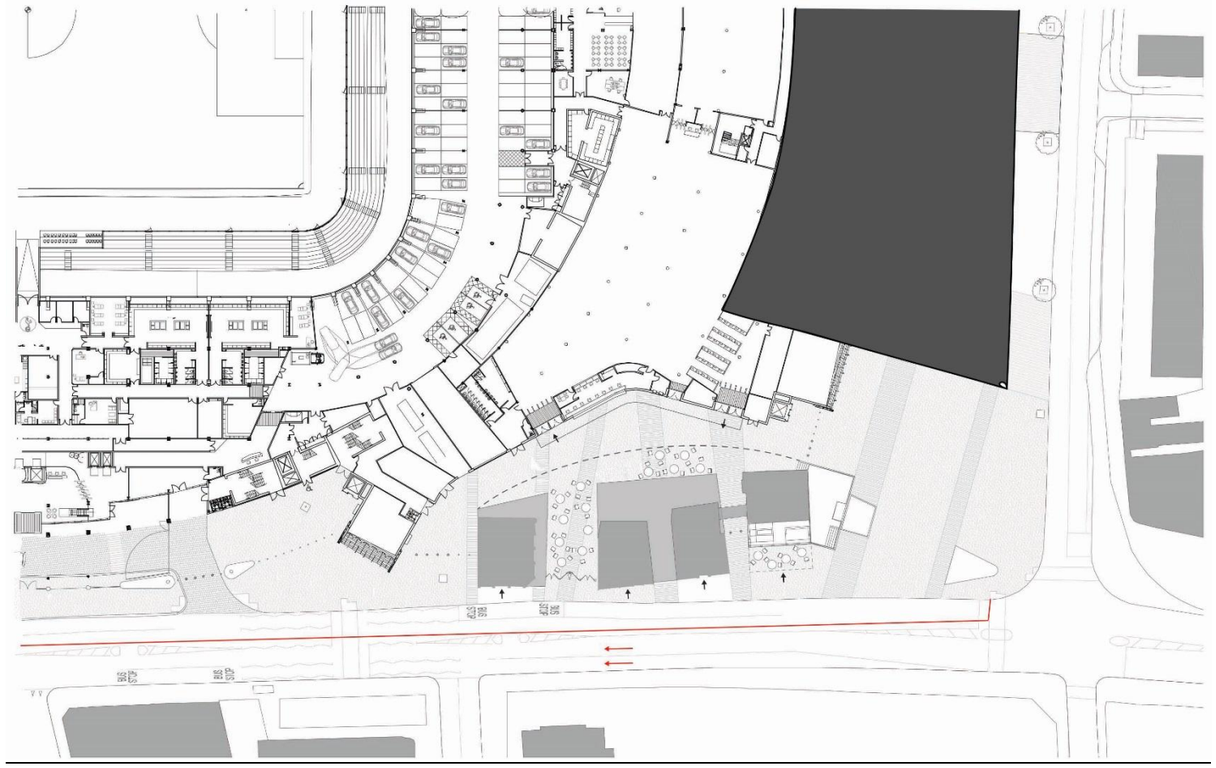
	HIGHWAYS AND TRANSPORT The southbound bus stop would need to be relocated further north for example to a point in front of the west side corporate spectator access or be removed without replacement. The traffic management restrictions would need to be implemented at the very least an hour and a half before the start of the major event.
	DELIVERABILITY The same issues apply as Option 1. The introduction of barriers would remove any prospect of entrances/access to the three buildings from the High Road on match days, channelling all the through the Canyon. The resultant conflicts with crowd flow would require additional intensive management and may impact upon external space provided for each of the buildings. This would further undermine the commercial viability of these units for F&B operators.
	CONCLUSION This option relies on successful management and pedestrian compliance of spectators and other pedestrians throughout the lifetime of the project for pedestrians to not be on the road. This is very unlikely to be achieved. The scheme does not allow for access to 746-750 High Road from the High Road on match day. The use of 746-750 High Road as F&B will create significant crowd management issues, likely to make the scheme unworkable due to the risk of severe congestion in the canyon and on the High Road. The risks of this scheme are built in for the lifetime of the stadium and there is little opportunity to provide further risk mitigation should it be required It does not achieve the objective of reducing the risk ALARP

3. Consented Scheme with Temporary Closure of the Southbound Bus Lane	Assessment
OPTION SUMMARY • Consented scheme with temporary closure of southbound road both pre and post-match • Barriers at western edge of road supported by stewards • Temporary rerouting of bus services • Allows pedestrians to use 'bus lane' • Barriers along road 	**CROWD SAFETY** The narrow point would now be 5.2m wide outside 748 High Road. Accounting for a 0.4m edge effect, the usable width would be 4.8m. Subtracting a further 1m for a barrier set back from vehicle traffic 3.8m is available for crowd circulation. The forecast for the flow per minute for the peak 15 minutes between Park Lane and the north of 750 High Road is 136 people per minute, (which excludes the flow for the Club shop). The forecast flow of 136 people per minute through this bottleneck (assuming no diversion to the canyon) gives a flow rate of 36 people/metre/minute (Fruin LOS C). If there is some limited diversion via the canyon then the width could be LOS B. Although this forecast excludes any demand created by provision of Food and Beverage. This LOS is worse than the targeted LOS A. It is likely that some people would walk on the wrong side of the barriers putting themselves at increased risk. The temporary barriers proposed for this option would increase the risk for pedestrians who find themselves in the roadway. Those people would be stuck between barriers on both sides of the road and vehicles for over 60m. That would put them at increased risk of a severe collision with a vehicle. Whilst the number of people in the road way would be reduced by the barriers, the increased risk for those in the roadway would increase the risk overall. This option does not reduce the risk to ALARP. Additionally the kerb edge would form a trip hazard. With this management solution directing people to walk diagonally across and parallel to this level change, it is almost certain to cause minor injuries. This would be an unacceptable risk which would not be consistent with reducing the risk to ALARP. This trip hazard would require mitigation such as making the roadway at the same level as the kerb. Such mitigation would require TfL approval and would not be feasible. The kerb is necessary for the safety of pedestrians at times when the barriers are not in place to separate vehicles and pedestrians. Without the kerb some form of protection such as bollards, barrier or guard rail would be needed. The 2.2 metre width is already too narrow and would not be sufficient to accommodate bollards, barrier or guard rail. Entrances to 746 – 750 on the High Road would not be operationally viable due to the impact on crowd flow. The external space at the rear would have to be bounded to allow circulation in the canyon, and control of access and queuing to the rear of the buildings external space when demand is unconstrained would require crowd management to prevent the risk of severe congestion in the canyon. This would be difficult to achieve while allowing circulation and access to the Club shop The width at the pinch point is less than recommended by the TfL Comfort Guidance section 3.6 (minimum 3.3m) for an 'Active flow' environment (>600p/hr; 10p/min). **HIGHWAYS AND TRANSPORT** The temporary 50-60 metre kerb build out would interfere with the new proposed pedestrian crossing of the

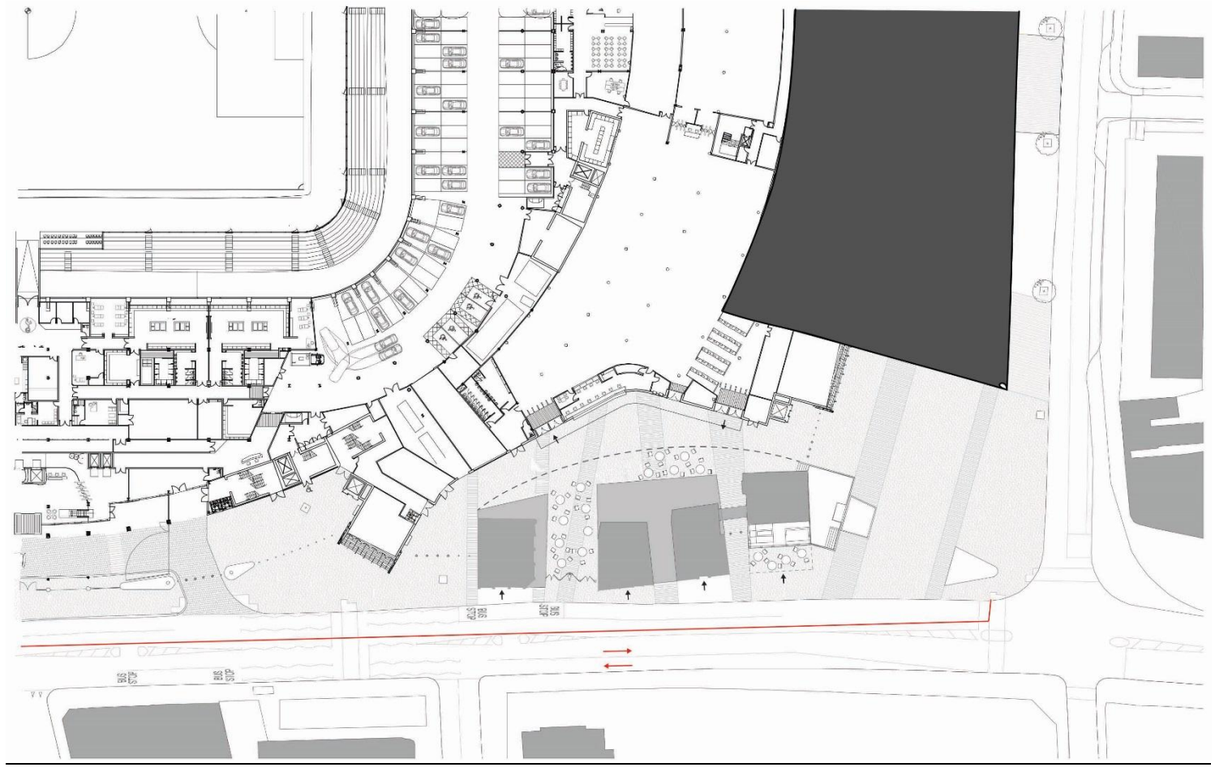
	High Road and the southbound bus stop. Buses would continue to use second southbound lane. Any additional traffic management measures/restrictions would result in a modest risk of causing local traffic congestion which would result in disruptions to access by emergency service vehicles. All 3 emergency services would be equally disrupted which would be a concern for the Stadium licensing body (Stadium Advisory Group as led by LB Haringey Building Control).
	DELIVERABILITY Access to the three buildings from High Road would not be achievable in this option. The requirement for external space to the rear still creates conflicts between the F&B use and the crowd flow through the Canyon. The external space at the rear would have to be bounded to allow circulation in the canyon, and control of access and queuing to the rear of the buildings when demand is unconstrained would require crowd management to prevent the risk of severe congestion in the canyon. As such, in terms of deliverability, there is no improvement on Option 1. The ability to secure a viable economic use for the three buildings is still uncertain.
	CONCLUSION This option relies on successful management and compliance of spectators and other pedestrians throughout the lifetime of the project for pedestrians to not be on the road. This is very unlikely to be achieved. It introduces additional risks for any spectators or other pedestrians not following the system, the vehicle drivers at risk of collision, and risks to the staff implementing the system. The option builds in a trip hazard, which is almost certain to cause minor injuries. It does not achieve the objective of reducing risk ALARP. The scheme does not allow for access to 746-750 High Road from the High Road on match day. The use of 746-750 High Road as F&B will create significant crowd management issues, likely to make the scheme unworkable due to the risk of severe congestion in the canyon. Therefore the operational and commercial viability of the use of 746-750 High Road for F&B is uncertain. The risks of this scheme are built in for the lifetime of the stadium and there is little opportunity to provide further risk mitigation should it be required.

4. Consented Scheme with Permanent Closure of the Southbound Bus Lane	Assessment
OPTION SUMMARY • Consented scheme with permanent closure of southbound road • Increase width of pavement in front of 746 – 750 High Road • Permanent rerouting of bus services 	**CROWD SAFETY** The narrow point outside 748 High Road would be 5.2m wide. Accounting for a 0.4m edge effect, the usable width would be 4.8m. The forecast flow of 136 people per minute through this bottleneck gives a flow rate of 28 people/metre/minute (Fruin LOS B). This exceeds the proposed target flow rate. The boundary of the walkway would be against the busier central road lane. People walking into this lane are at greater risk than people walking into the outside southbound lane in the other options. People move to avoid pedestrian - pedestrian conflicts even at low flow rates so a risk remains during peak ingress periods. Barriers and stewards could be introduced as further mitigation along both eastern and western pavements (this latter to stop informal crossing into a barrier on the eastern side) to manage this risk as per option 3. However, introduction of barriers would reduce the available width and increase the flow rate, and creates risks described in other options:any non-compliant spectators or other pedestrians would now be forced into the main carriageways, where there would be more traffic. Entrances to the three buildings from the High Road would not be viable for match-day as no queuing, waiting or congestion can be allowed on this stretch of walkway. External space at the rear would have to be limited and contained to allow circulation in the canyon, and control of access and queuing to the rear of the buildings external space when demand is unconstrained would require crowd management to prevent the risk of severe congestion in the canyon. Queueing into the F&B would have to be controlled, while allowing circulation and access to the Club shop, which would be difficult to achieve.
	HIGHWAYS AND TRANSPORT The southbound nearside lane is painted red as a “bus lane” however it is available for general traffic at most times when there would be a major event at the new stadium. The operational hours of the north to south bus lane are 7am till 1pm Monday to Friday (and occasionally Saturday) It is still a traffic lane used by a large number of buses and general traffic does tend to avoid the use of the bus lane even when it is not operational. The removal of this lane to create a wider walkway, would need to satisfy highway design standards. The longer permanent 100+ metre kerb build out would interfere with the new pedestrian crossing of the High Road and the southbound bus stop as well as removing the local bus priority at all times. Any additional and permanent traffic management measures/restrictions would result in a significant risk of causing local traffic congestion which would result in disruptions to access by emergency service vehicles. All

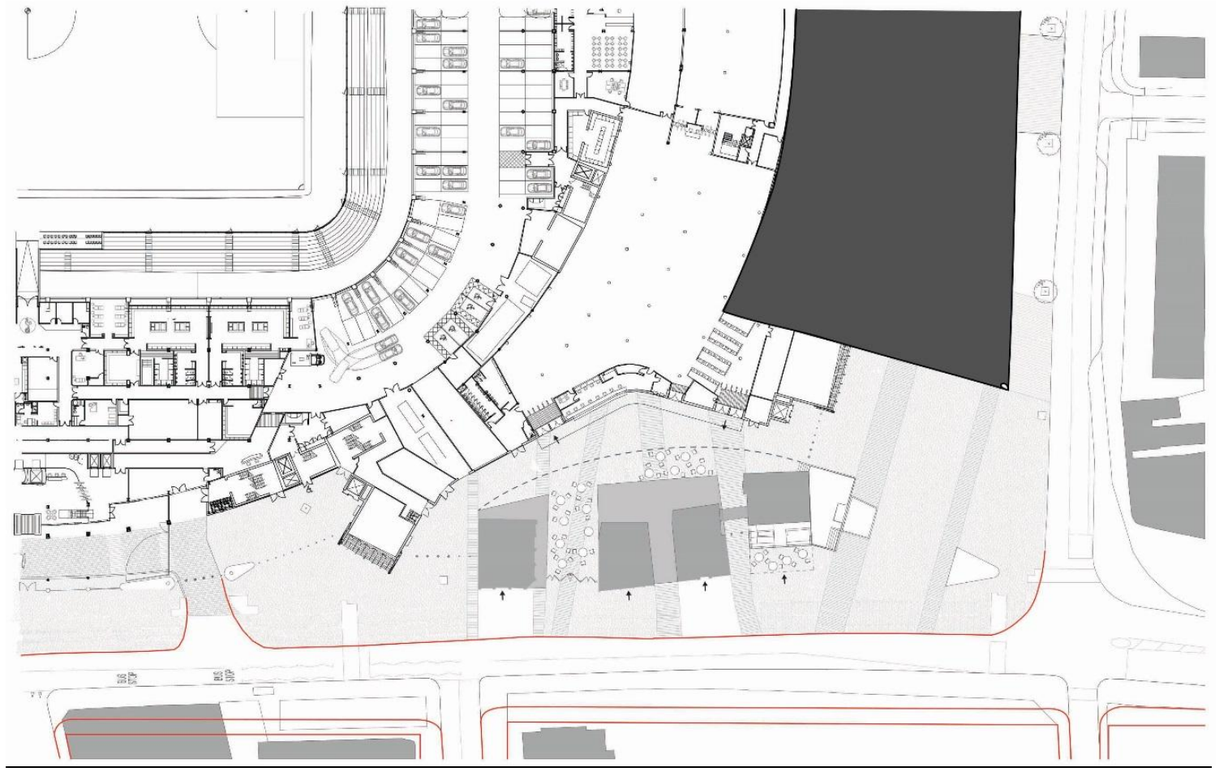
	3 emergency services would be equally disrupted which would be a concern for the Stadium licensing body (Safety Advisory Group as led by LBH Building Control). The permanent removal of a section of the road to provide the increased walkway width would cause delays to each and every bus service which would amount to a substantial financial penalty in terms of social and economic dis-benefits. This section of the High Road is a strategically important bus corridor – particularly so given the level of use during the weekday commuter AM peak periods.
	DELIVERABILITY There is a marginal improvement as it creates more space in front of the three buildings outside event days, but the viability of reoccupying the buildings for F&B and their ability to operate satisfactorily in this option remains uncertain.
	CONCLUSION This option moves the pedestrian – vehicle boundary to the central carriageway, where any pedestrians straying into the road are at risk of pedestrian-vehicle conflicts. The conditions would be LOS B making it more likely that pedestrians will step into the road than other options. This can be managed by introduction of barriers and stewards, but then this retains the risk arising from spectator non-compliance as in option 3. It does not provide as much space or as low flow rates as other options. It does not achieve the objective of reducing the crowd safety risk ALARP. The scheme does not allow for access to 746-750 High Road from the High Road on match day. The use of 746-750 High Road as F&B will create significant crowd management issues, likely to make the scheme unworkable due to the risk of severe congestion in the canyon. Therefore the operational and commercial viability of the use of 746-750 High Road for F&B is uncertain. The risks of this scheme are built in for the lifetime of the stadium and there is little opportunity to provide further risk mitigation should it be required.

5. Consented Scheme with Temporary Closure of Both Southbound Lanes	Assessment
OPTION SUMMARY • Consented scheme with temporary closure of southbound lane and road pre- and post-match • Temporary increase in width of pavement to include road • Rerouting of bus services and southbound vehicular traffic 	**CROWD SAFETY** This would deliver a significant benefit for crowd flow. The narrow point would now be approximately 8.2m wide. Accounting for a 0.4m edge effect, the usable width would be 7.8m. The forecast flow of 136 people per minute through this bottleneck gives a flow rate of 17 people/minute (Fruin LOS A). The road-walkway boundary could be demarcated by a barrier, if required, in the second lane to provide a buffer vs. traffic however this would put people at risk of being stuck between the barrier and a vehicle lane. On match day, entrances to 746 – 750 High Road would need to be controlled to prevent queueing and assembly outside the buildings on the High Road, which would require stewarding and be difficult in practice (itself likely to create congestion). There is also the problem of managing demand so that any queuing or waiting outside the buildings does not become unmanageable. Access to the front of the buildings is not recommended. There is a risk of congestion in the canyon, preventing access to the Club shop. Additionally the kerb edge would form a trip hazard. With this management solution directing people to walk diagonally across and parallel to this level change, it is almost certain to cause minor injuries. This would be an unacceptable risk which would not be consistent with reducing the risk to ALARP. This trip hazard would require mitigation such as making the roadway at the same level as the kerb. Such mitigation would require TfL approval and would not be feasible. The kerb is necessary for the safety of pedestrians at times when the barriers are not in place to separate vehicles and pedestrians. Without the kerb some form of protection such as bollards, barrier or guard rail would be needed. The 2.2 metre width is already too narrow and would not be sufficient to accommodate bollards, barrier or guard rail. The width at the pinch point is less than recommended by the TfL Comfort Guidance section 3.6 (minimum 3.3m) for an ‘Active flow’ environment (>600p/hr; 10p/min) on non-match-day. **HIGHWAYS AND TRANSPORT** Pre-match bus diversions to the west of the stadium (the existing post-match diversion) would result in increased operating costs and reduced passenger revenue. Pre-match bus diversions to the east of the stadium (a modified diversion) would also result in increased operating costs and reduced passenger revenue. It is very unlikely that diverted bus services would ever return to the High Road during the major event. This would be an issue at any time but particularly in the tail of the weekday evening peak hour. The priority of the bus operator is to maintain the bus frequency, per hour, and average waiting time, minutes per bus. This is particularly the case for the much longer west side diversion. The west side bus diversion would render the services unusable by spectators pre-match which would undermine the major event transport strategy.

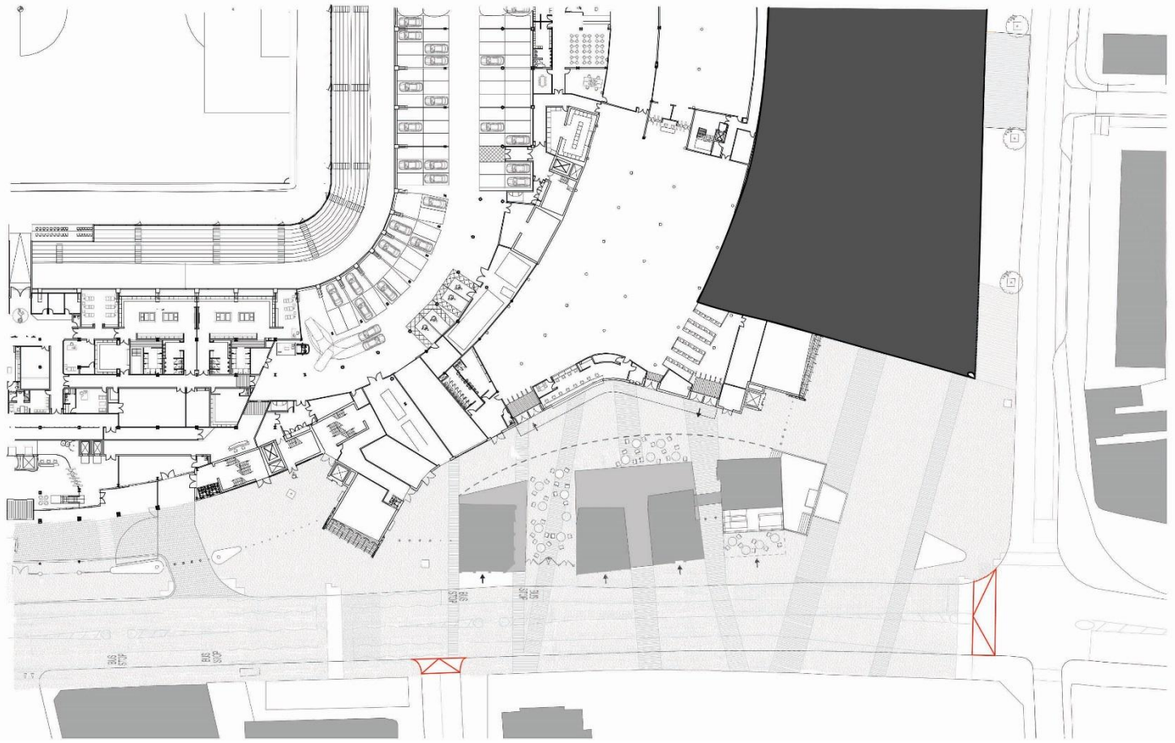
	Up to 10% of spectators are expected to use scheduled bus services pre-match. The west side diversion takes services away from the regeneration area which would result in considerable 'accessibility' difficulties if the diversion was to last up to 4-5 hours. The use of the shorter east side bus diversion would not materially reduce the timescale and inconvenience of the bus diversions. Any additional traffic management measures/restrictions would run a very high risk of causing considerable local traffic congestion which would result in disruptions to access by emergency service vehicles. All 3 emergency services would be equally disrupted which would be a significant concern for the Stadium licensing body (Stadium Advisory Group as led by LBH Building Control).
	DELIVERABILITY As Option 3. This option also depends on the ability to secure the necessary consent for the temporary closure of both southbound lanes, which would be challenging given the issues outlined above. This would also present uncertainty and delay in respect of the delivery of a workable solution.
	CONCLUSION This delivers benefits for crowd flow, but the introduction of a level change introduces risk and the proposal does not reduce risk to ALARP. The option would have a significant detrimental impact on the wider transport issues and in particular the overall transport strategy for the stadium.

6. Consented Scheme with Temporary Closure of Both Southbound Lanes and Contraflow on Northbound Carriage	Assessment
OPTION SUMMARY • Consented scheme with temporary closure of southbound lane and road pre- and post-match • Temporary increase in width of pavement to include road • Contraflow introduced on northbound carriage to allow for two way flow of traffic 	**CROWD SAFETY** This would deliver a significant benefit for crowd flow. The narrow point would now be approximately 8.2m wide. Accounting for a 0.4m edge effect, the usable width would be 7.8m. The forecast flow of 136 people per minute through this bottleneck gives a flow rate of 17 people/minute (Fruin LOS A). The road-walkway boundary could be demarcated by a barrier, if required, in the second lane to provide a buffer vs. traffic. On match day, entrances to 746 – 750 High Road would need to be controlled to prevent queueing and assembly outside the buildings, which would require stewarding and be difficult in practice (itself likely to create congestion). There is also the problem of managing demand so that any queuing or waiting outside the buildings does not become unmanageable. Access to the front of the buildings is not recommended. There is a risk of congestion in the canyon, preventing access to the Club shop. Additionally the kerb edge would form a trip hazard. With this management solution directing people to walk diagonally across and parallel to this level change, it is almost certain to cause minor injuries. This would be an unacceptable risk which would not be consistent with reducing the risk to ALARP. This trip hazard would require mitigation such as making the roadway at the same level as the kerb. Such mitigation would require TfL approval and would not be feasible. The kerb is necessary for the safety of pedestrians at times when the barriers are not in place to separate vehicles and pedestrians. Without the kerb some form of protection such as bollards, barrier or guard rail would be needed. The 2.2 metre width is already too narrow and would not be sufficient to accommodate bollards, barrier or guard rail. The width at the pinch point is less than recommended by the TfL Comfort Guidance section 3.6 (minimum 3.3m) for an ‘Active flow’ environment (>600p/hr; 10p/min) on a non-match day.
	HIGHWAYS AND TRANSPORT Southbound traffic cannot operate safely as a contra-flow within the northbound carriageway without causing considerable congestion and safety issues. The existing northbound traffic lane is too narrow to allow temporary 2-way operation so the carriageway would need to be significantly widened coupled with removable street furniture such as, guard railings, traffic islands and traffic signal poles. All the traffic lights would need to be turned off and covered and the temporary centre line would need to be coned/barriered – there is insufficient width available to do this without undermining the benefit to pedestrians of the temporary carriageway closure The traffic management restrictions would probably need to be put in place and removed overnight when traffic flows are very low. This would therefore involve the all day closure of the roads and bus stops which would be a particular problem for TfL with regard to midweek fixtures.

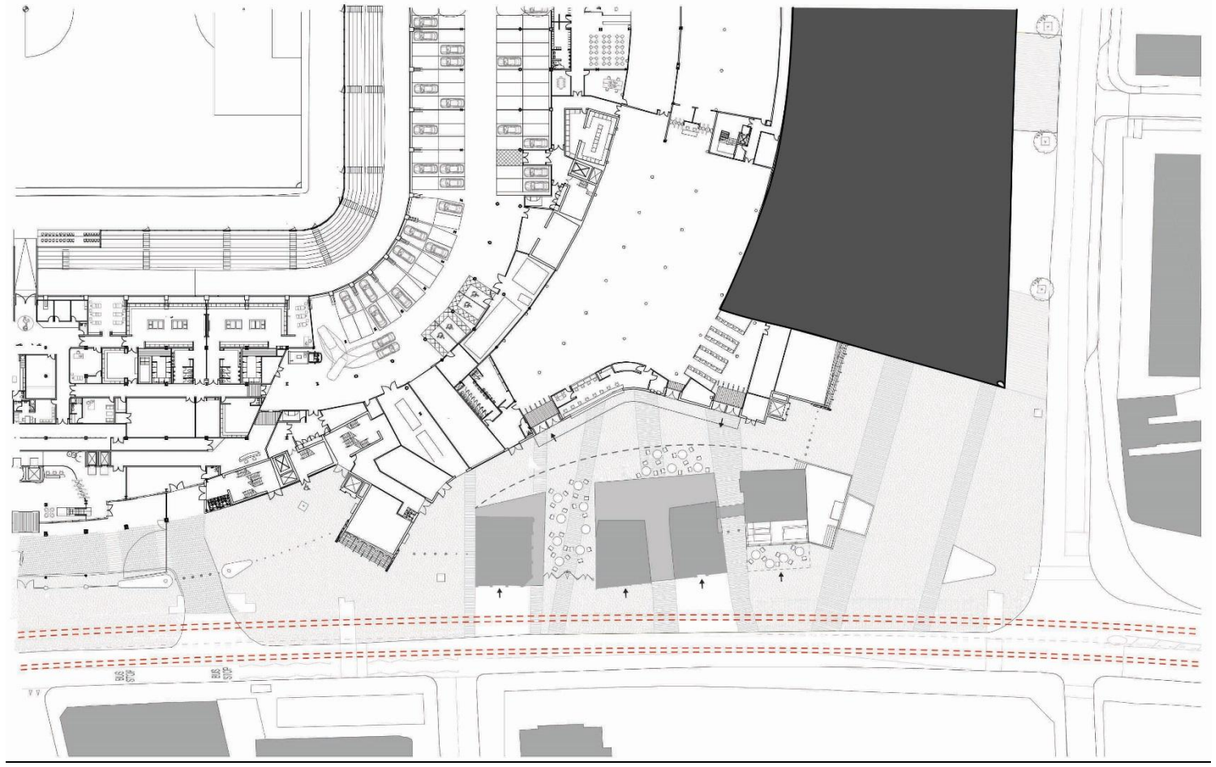
	Any additional traffic management measures/restrictions would run a very high risk of causing considerable local traffic congestion which would result in disruptions to access by emergency service vehicles. All 3 emergency services would be equally disrupted which would be a significant concern for the Stadium licensing body (Stadium Advisory Group as led by LBH Building Control).
	DELIVERABILITY As Option 3. This option also depends on the ability to secure the necessary consent for the permanent closure of both southbound lanes, which would be very challenging given the issues outlined above. This would also present uncertainty and delay in respect of the delivery of a workable solution
	CONCLUSION This delivers benefits for crowd flow, but the introduction of a level change introduces risk and the proposal does not reduce risk to ALARP. This option would have a considerable detrimental impact on the highways network and on the transport strategy for the new stadium

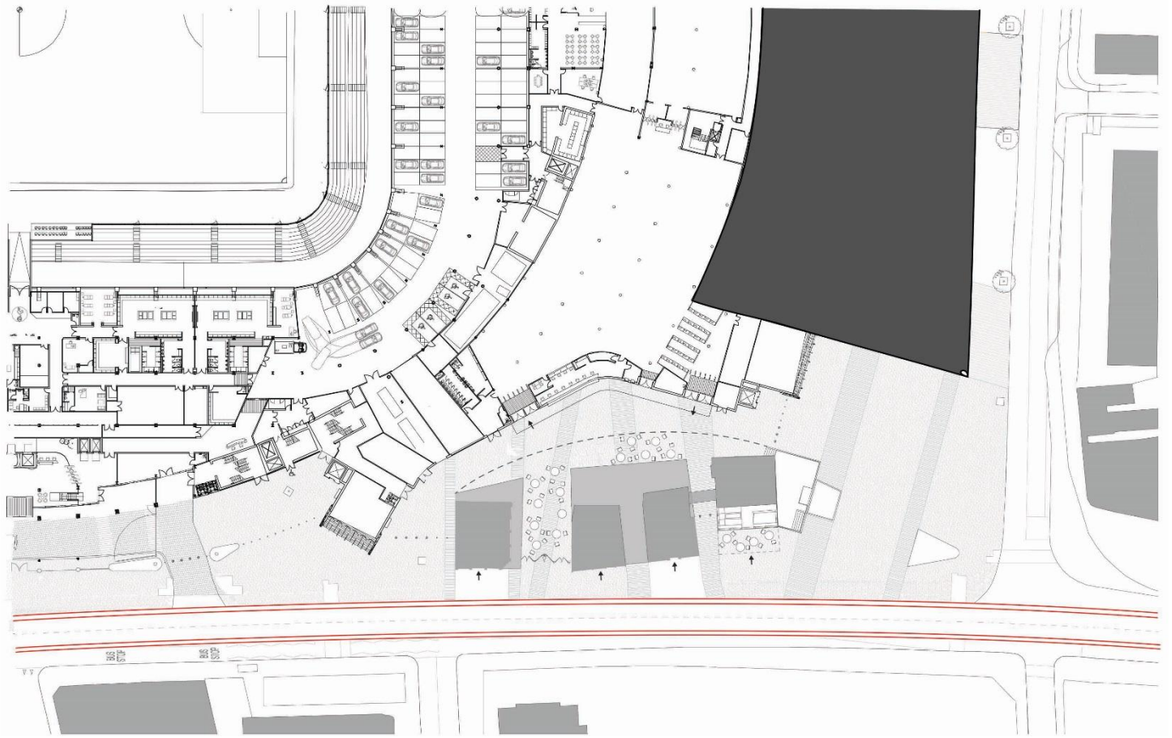
7. Consented Scheme and Move High Road Westwards	Assessment
OPTION SUMMARY • Consented scheme with increased footpath width on eastern side outside 746 -750 High Road • Alignment of High Road moved further westwards 	**CROWD SAFETY** Potentially of significant benefit if the High Road is moved far enough west. If the road is moved 5m west and there are no entrances to 746 - 750 High Road on the High Road then the scheme would provide similar flow rates to the Populous scheme. With 5m additional width, the total width would be 7.2m at the narrowest point (6.8m considering edge effects). This gives a flow rate of 20 people/metre/minute. On match day, entrances to 746 – 750 High Road would need to be controlled to prevent queueing and assembly outside the buildings, which would require stewarding and be difficult in practice (itself likely to create congestion). There is also the problem of managing demand so that any queuing or waiting outside the buildings does not become unmanageable. Access to the front of the buildings is not recommended. Congestion in the canyon due to high demand for F&B units would inhibit access to the Club Shop/ **HIGHWAYS AND TRANSPORT** There is a strong likelihood that the recent TfL design guidance would support much wider walkways for 365 day activity levels on both sides of the High Road so the impact on existing buildings on the west side of the street might be even greater than shown in the sketch.

	DELIVERABILITY This improves the commercial attractiveness of the three buildings. However the cost of delivery in terms of highways, utilities, land assembly, and likely impact on other heritage assets make this option undeliverable. It would also impact upon LB Haringey's wider regeneration aspirations for the High Road West area. This option would fundamentally change the nature of the street, changing the road's historic alignment and would require the removal of designated heritage assets on the west side of the High Road. This would be very harmful to the North Tottenham Conservation Area. There would not be sufficient justification to promote the necessary compulsory purchase order, even if commercial viable.
	CONCLUSION This option would potentially resolve the crowd safety issue but in practice is likely to be undeliverable and would have a greater detrimental effect on the North Tottenham Conservation Area that the proposed Populous scheme. Access to 746-750 High Road used as F&B could be allowed depending on the width available at the front but management of queuing would need to be tightly controlled, which would be difficult if demand is unconstrained. No congregation in the front of the building could be allowed. Constraints would reduce the building's viability.

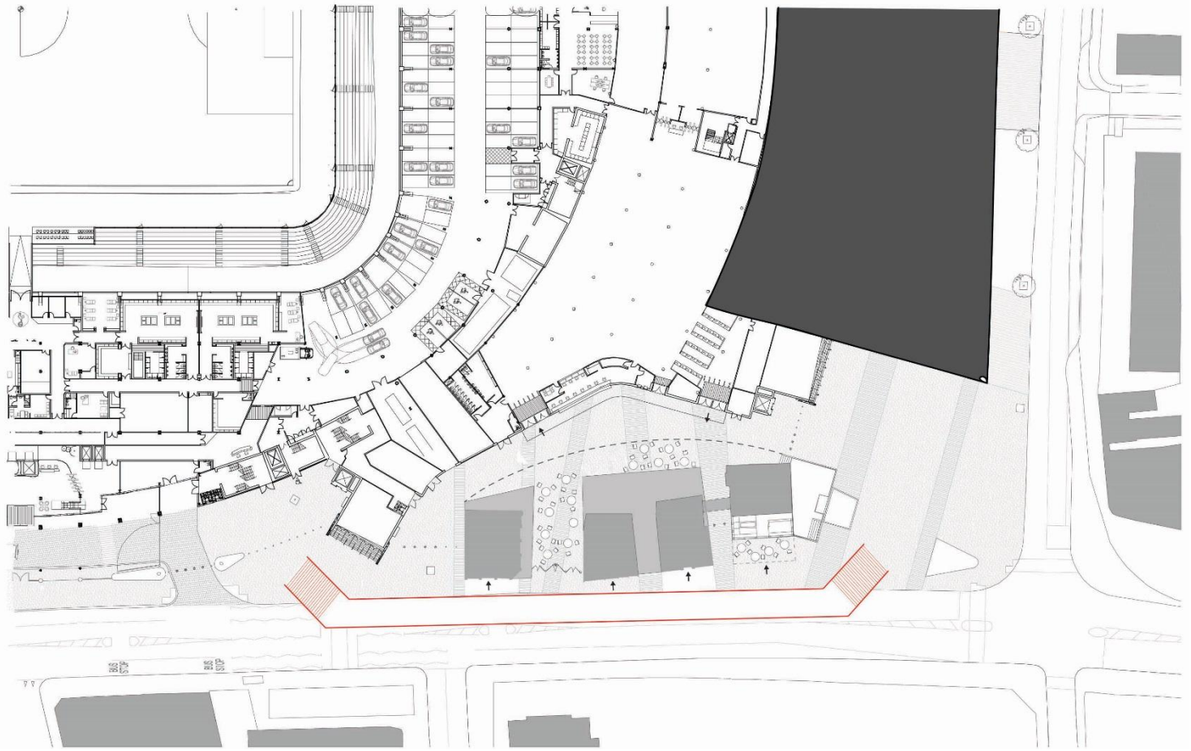
8. KSS Consented Scheme and Shared Surface on High Road	Assessment
OPTION SUMMARY • KSS scheme with shared surface on High Road from Park Lane to White Hart Lane 	**CROWD SAFETY** As per the Highways and Transport assessment below, a shared space scheme is not feasible on a match day. Pedestrians would fill the road and present significant risks of pedestrian-vehicle conflicts, particularly if drivers are frustrated by delays. Crowd congregation, associated with use of 746-750 High Road for F&B, could not be allowed as it would interfere with traffic. **HIGHWAYS AND TRANSPORT** The High Road is a busy and highly regulated street so the light touch shared surface approach would be very dangerous. This would result in substantial numbers of road traffic accidents with the existing level of use of the High Road. High frequency bus services and large pedestrian crossing movements require proper management and regulation. In the pre-event period it is likely that the dominant pedestrian movements would take control of the street and this would result in traffic gridlock. The High Road traffic flow next to the four building on a typical weekday is over 20,000 vehicles a day including substantial number of buses, coaches and commercial vehicles. This street is not a candidate street for the same shared surface approach adopted at Exhibition Road in Kensington where there are very few buses, coaches or commercial vehicles. The High Road hourly traffic flows on a weeknight from 6:45 to 7:45, the minimum pre-match traffic management period as assessed in this report, are as follows; Total vehicles – 1042 (including 84 cyclists) Car/taxis – 802 Light Goods Vehicles – 85 Medium Rigid Commercial Vehicles – 3 Articulated HGV – 0 Buses and Coaches – 77 (1 every 47 seconds) Motorcycles - 27 Any additional traffic management measures/restrictions would run a very high risk of causing considerable local traffic congestion which would result in disruptions to access by emergency service vehicles. All 3 emergency services would be equally disrupted which would be a significant concern for the Stadium licensing body (Stadium Advisory Group as led by LBH Building Control).

	DELIVERABILITY The viability of three buildings could be marginally improved in this option however for the crowd safety and highways issued described above it is not deliverable.
	CONCLUSION This option is not feasible for the High Road. It would give rise to even greater risk of pedestrian-vehicle conflict and would result in traffic gridlock before a game.

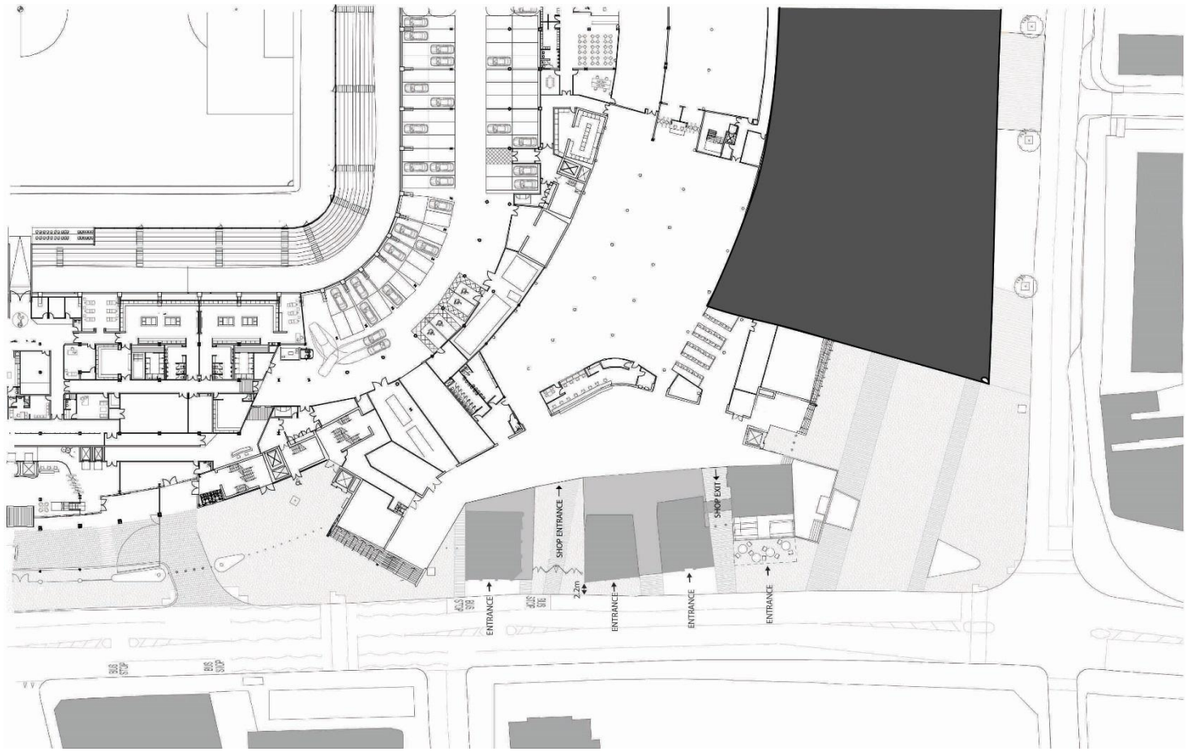
9. Consented Scheme and Tunnel the High Road	Assessment
OPTION SUMMARY • Consented scheme with vehicular traffic diverted under a tunnel to increase pavement width at ground floor level 	**CROWD SAFETY** It is assumed that one vehicle lane in each direction would remain, and that this would carry local traffic only. The relative density of vehicles in the tunnel and above ground is not yet known. The alignment of the remaining lanes would provide need to provide additional walkway width to the eastern side of the High Road, sufficient to provide capacity for spectators to move without the need to move into the road. If the two remaining vehicle lanes are aligned with the central lanes now but wider, then the additional width would be less than that provided by the road, suggesting that the alignment would need to be towards the western pavement. Barriers (and supporting stewarding) may still be required to demarcate the pedestrian-vehicle boundary.
	HIGHWAYS AND TRANSPORT It would be very difficult to locate the tunnel portals to the north and south without extensive demolition of existing buildings. The tunnel section would be very expensive to build and would disrupt existing utility services. If would take many years of highly disruptive construction to implement even with the simplest cut and cover option. The local traffic and bus services would remain at grade in a 2 lane carriageway which would need to be almost as wide as the existing 4-lane cross-section.
	DELIVERABILITY This would change the nature of the street and would significantly harm this Conservation area (and potentially others) as well as any HAs in the vicinity of the tunnel entrances. While adjacent to the application site a tunnel would lead to an improvement of environmental conditions, at the entrances it would fundamentally harm the townscape, changing the relationship with the road and the buildings flanking it. Leaving aside the technical issues involved, and the delay and uncertainty in securing the necessary consent, the cost of this option makes it unviable, and disproportionate to any benefits.
	CONCLUSION This option is considered undeliverable. In any event it is likely to have a significantly more harmful impact in heritage terms that the Populous Scheme.

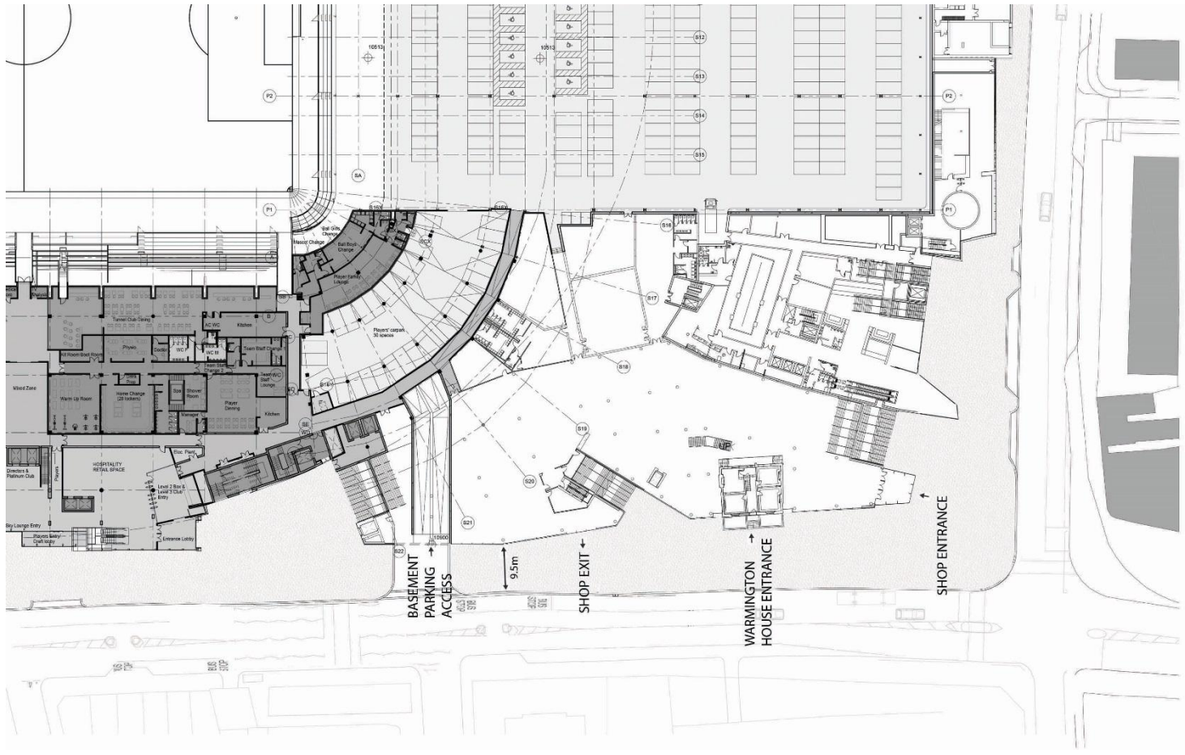
10. KSS Consented Scheme and Flyover	Assessment
OPTION SUMMARY • KSS scheme with vehicular traffic diverted over a flyover to increase pavement width at ground floor level 	**CROWD SAFETY** It is assumed that one vehicle lane in each direction would remain, and that this would carry local traffic only. The relative density of vehicles on the flyover and at grade is not yet known. The alignment of the remaining lanes would provide need to provide additional walkway width to the eastern side of the High Road, sufficient to provide capacity for spectators to move without the need to move into the road. If the two remaining vehicle lanes are aligned with the central lanes now but wider, then the additional width would be less than that provided by the road, suggesting that the alignment would need to be towards the western pavement. Barriers (and supporting stewarding) would still be required to demarcate the pedestrian-vehicle boundary.
	HIGHWAYS AND TRANSPORT It would be very difficult to locate the up/down ramps to the north and south without extensive demolition of existing buildings. The flyover section would be very expensive to build and would disrupt existing utility services. If would take many years of highly disruptive construction to implement even with the simplest central support option. The local traffic and bus services would remain at grade in a 2 lane carriageway which would need to be almost as wide as the existing 4-lane cross-section – particularly given the overhead structure.
	DELIVERABILITY This would change the nature of the street and would significantly affect the setting of the Conservation area and all the Heritage Assets in it. A flyover would fundamentally harm the townscape, changing the relationship with the road and the buildings flanking it. In addition the up and down ramps may require substantial further demolition of HAs, presumably on the West side of the High Road. Leaving aside the technical issues involved, and the delay and uncertainty in securing the necessary consent, the cost of this option makes it unviable, and disproportionate to any benefits.

	CONCLUSION This option is considered undeliverable. In any event it is likely to have a significantly more harmful impact in heritage terms that the Populous Scheme.

11. KSS Consented Scheme and Pedestrian Bridge / Walkways	Assessment
OPTION SUMMARY • KSS scheme with new pedestrian walkway along eastern side of High Road that separates the pavement from vehicular traffic. 	**CROWD SAFETY** This is worse than option 1. People will be unwilling to go up and back down again to use an overpass (more so than using the canyon). This would only be effective if it catered for the desire line in three dimensions. People would continue to use the narrow footpath unless it was blocked off completely. The stairs/ramps to the raised walkway would reduce footpath width for other movements and would likely more people to walk into the roadway If the footpath was blocked there would be a risk of people walking in the road without any escape from oncoming vehicles.
	HIGHWAYS AND TRANSPORT Assuming that any structural supports for the pedestrian bridges do not impact on the roadway, and that the roadway would be unchanged in this option from option 1, the analysis is therefore the same as option 1.
	DELIVERABILITY This would fundamentally change the nature of the street. The raised walkway would cause substantial harm to the Conservation Area and numerous heritage assets. Leaving aside the technical issues involved, and the delay and uncertainty in securing the necessary consents, the cost of this option makes it unviable, and disproportionate to any benefits.

	CONCLUSION This does not meet the objective of reducing the crowd safety risk to ALARP. Furthermore it is not considered deliverable and would cause substantial harm to the Conservation Area and numerous heritage assets.

12. Consented Scheme with Extended Podium	Assessment
OPTION SUMMARY • A fundamental redesign of the Consented Scheme to close the canyon and bring the podium closer to the rear of the buildings 	**CROWD SAFETY** People will be unwilling to go up and back down again to use the podium to circumnavigate 744-750 High Road (more so than using the canyon). This would only be effective if it catered for the desire line in three dimensions. The overwhelming majority of people would continue to use the narrow footpath unless it was blocked off completely (in which case the same issues identified in respect of Option 2 would arise). Thus the risk will be similar to, if not worse than, option 1. Entrances to 746 – 750 on the High Road would not be operationally viable. These would need to be closed on match day. As a result there would be no ground floor match day access
	HIGHWAYS AND TRANSPORT The southbound bus stop would need to be relocated further north perhaps to a point in front of the west side corporate spectator access or be removed without replacement.
	DELIVERABILITY Without ground floor match day access to 746-750 high road any potential commercial viability would be compromised. As such, in addition to the significant crowd safety issues involved, this would not safeguard the future viability of the buildings.
	CONCLUSION This would not resolve the crowd safety risks associated with Option 1. It would not meet the objective of reducing the risk ALARP.

13. Populous Scheme	Assessment
	**CROWD SAFETY** This is demonstrably the safest option. It provides space for crowd flow so that pedestrians can walk the way they want to without stepping off the footpath. The walking area of the footpath will be protected by bollards. There is a space of 85cm between the kerb edge and this walking area. This acts as a buffer, so if people step outside of this walking area remain on the pavement. The predicted flow of 185 people per minute through a width of 9.5m less 1.05m for bollards and edge effect gives a flow rate of 22 people/metre/minute LOS A. It provides a wide walkway allowing for manoeuvring away from the road. Management measures, such as those discussed above, could be added as required, so this solution provides resilience. **HIGHWAYS AND TRANSPORT** The current Populous scheme is entirely consistent with the proposed stadium transport strategy. The proposed traffic management strategy makes the best use of the space available within the High Road to satisfy the possibly conflicting requirements of spectators, other pedestrians, bus operators and their passengers and stadium access by private vehicles, coaches/shuttle buses and the emergency services. **DELIVERABILITY** The Populous scheme is viable, subject to gap funding, and deliverable without delay, subject to planning. The proposals would see the loss of three locally listed buildings, which is a ‘planning risk’. However, in the absence of any viable alternative which retains them, and taking into account the overall planning balance (see Planning Statement) there is a sound justification for their loss. In townscape terms this would be a great improvement over the other options and, indeed, in bringing life and interest to the High Road itself this would mean the conservation area would be invigorated and enlivened, resulting in major benefits. This option also provides a long term viable use for Warmington House

	CONCLUSION This option is the safest option, is deliverable, subject to planning, and is entirely consistent with the overall transport strategy.

9.0 Concluding Summary

9.1 We set out the results of the option appraisal below, based on the three criteria of crowd safety, traffic and highways impact, and viability/Deliverability.

Option Appraisal Summary	Crowd Safety	Highways	Deliverability
1. The Consented Scheme with no mitigation	✗	✓	✗
2. The Consented with barriers and stewarding	✗	✓	✗
3. The Consented Scheme with temporary closure of the Southbound bus lane	✗	✓	✗
4. The Consented Scheme with permanent closure of the Southbound bus lane	✗	✗	✗
5. Consented Scheme with Temporary Closure of Both Southbound Lanes	✗	✗	✗
6. The Consented Scheme with the temporary closure of both Southbound lanes and contraflow on the Northbound carriageway	✗	✗	✗
7. The Consented Scheme moving High Road westwards	✓	✗	✗
8. The Consented Scheme and shared surface on the High Road	✗	✗	✗
9. The Consented Scheme with a tunnel the High Road	✓	✗	✗
10. The Consented Scheme and Flyover above the High Road	✓	✗	✗
11. The Consented Scheme and pedestrian Bridge/walkways over the three buildings	✗	✗	✗
12. The Consented Scheme with an increased Podium	✗	✓	✗
13. The Populous Scheme	✓	✓	✓

9.2 This demonstrates that the only alternative options for retaining the locally listed buildings which are likely to address the requirements for crowd safety, and to reduce the risks to ALARP, are unacceptable in traffic and highways terms and incapable of being delivered. The cost, additional impacts and delays involved, and ultimately risk to the wider regeneration are disproportionate to any benefits they could deliver.

9.3 None of the less radical options offers an acceptable solution to the identified risks to crowd safety. In any event, in addition to the significant risks to public safety, the level of overcrowding in this identified pinch point would call into question the ability to secure viable commercial uses for the buildings, which in turn calls into question the viability of retaining the buildings in these scenarios.

9.4 The only option that is viable and deliverable, subject to planning, and meets the requirements for crowd safety and highways is the Populous Scheme, which necessitates the loss of these buildings. Taking the wider heritage and planning issues into account, including the significant heritage and wider regeneration benefits which are set out in the Planning Statement, there is clear justification for the loss of these buildings. Any localised heritage impact is more than offset by the wider heritage and other public benefits which the development delivers.